Compressed Air Magazine

JANUARY 1957

HIS HOSE SPRAYS SAND AND STEEL
Helmeted blaster cleaning welded section of big steam condenser

VOLUME 62 • NUMBER 1 NEW YORK • LONDON

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The kind of air a man works in has a lot to do with how much work he can turn out.

In confined places like shipholds or tanks or drums or boilers . . . or wherever the air is stagnant or hot or full of fumes . . . a Coppus Blower is a *must* for getting first-class work out of the men, all the time.

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Portable and adaptable for special purposes, Coppus Blowers and Exhausters will have dozens of uses around your plant. The "Blue Ribbon" (a blue painted band) is your assurance of quality performance at lowest cost.

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THE BLOWERS THAT PUT MORE MINUTES IN EVERY MAN-HOUR

CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON To Coppus Engineering Corp., 201 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

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- ☐ in underground cable manholes.
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- ☐ on coke ovens.
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- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
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(Write here any special ventilating problem you may have.)

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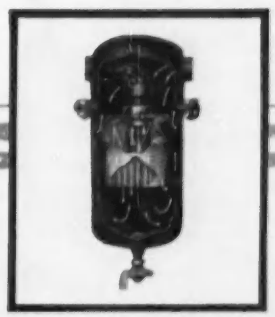
KEEP IT CLEAN... by Phil Tration



Filtering "sound and fury," as shown in the cartoon, is what Walt Disney would call a *plausible impossible* use for Dollinger Filters. In industry today, however, practically any gas, liquid, or air *can* be handled more efficiently with Staynew Filters. They protect machines or processes, or workers from the damage caused by dust, dirt, oil, grease, or other foreign matter. In thousands of industrial and ventilating applications throughout the world, Staynew Filters have become recognized as the highest standard of quality available.

STAYNEW MODEL CPH PIPE LINE FILTER has the exclusive "double action principle." Air is first deflected to outer walls of Filters and forced downward at high speed. Water, oil, and heavier particles of rust, etc. are thus deposited in base. Mechanically cleaned air then rises to pass through filtering medium which removes lighter airborne particles. This "double action" design eliminates need for frequent cleaning.

Inexpensive, simple to install, Dollinger Pipe Line Filters pay for themselves in reduced maintenance alone. Why not talk over your filtration problems with a Dollinger engineer . . . or write for Bulletin 200 which gives engineering data on pipe line filters. Dollinger Corporation, 7 Centre Park, Rochester 3, N.Y.

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COMPRESSED AIR MAGAZINE

READERS SERVICE CARD — **January, 1957**

Please send me additional information and literature on items circled below.

1A	2A	3A	4A	5A	6A	7A	8A	1E	2E	3E	4E	5E	6E	7E	8E
9A	10A	11A	12A	13A	14A	15A	16A	9E	10E	11E	12E	13E	14E	15E	16E
17A	18A	19A	20A	21A	22A	23A	24A	17E	18E	19E	20E	21E	22E	23E	24E
25A	26A	27A	28A	29A	30A	31A	32A	25E	26E	27E	28E	29E	30E	31E	32E
33A	34A	35A	36A	37A	38A	39A	40A	33E	34E	35E	36E	37E	38E	39E	40E
41A	42A	43A	44A	45A	46A	47A	48A	41E	42E	43E	44E	45E	46E	47E	48E
49A	50A	51A	52A	53A	54A	55A	56A	49E	50E	51E	52E	53E	54E	55E	56E
57A	58A	59A	60A	61A	62A	63A	64A	57E	58E	59E	60E	61E	62E	63E	64E

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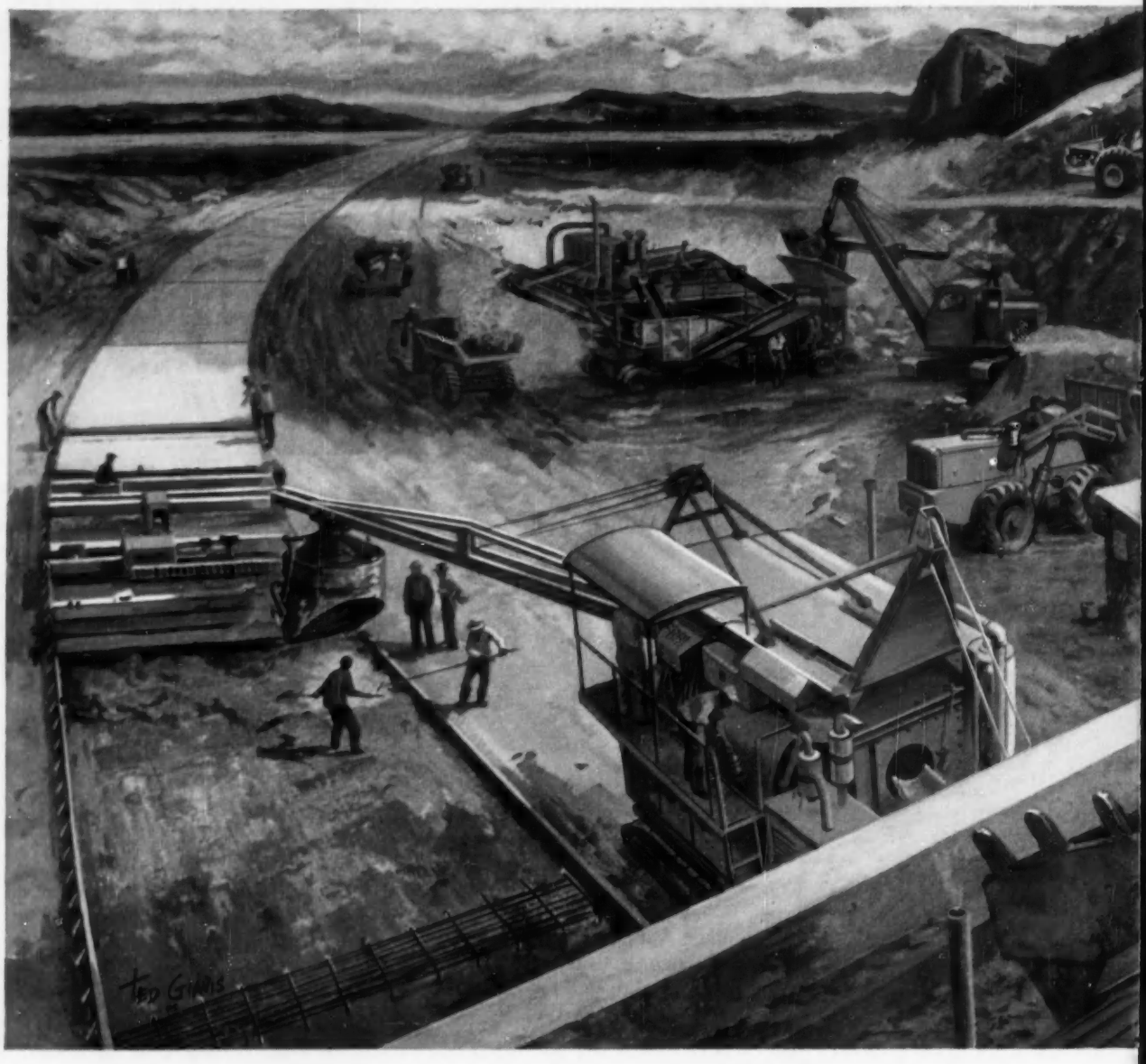
What's the most versatile



It's GM—Choice of more than 150 equipment builders

General Motors Detroit Diesel engines power more different types of road-building equipment—built by more manufacturers—than any other Diesel.

These versatile two-cycle engines drive compressors, crushers, drills, pavers, graders, shovels and the world's most powerful off-highway vehicles.

Leading manufacturers install GM Detroit Diesel power in more than 1000 different machinery applications because it gives their customers unequaled work output and dependability, plus the backing of a world-wide service organization.

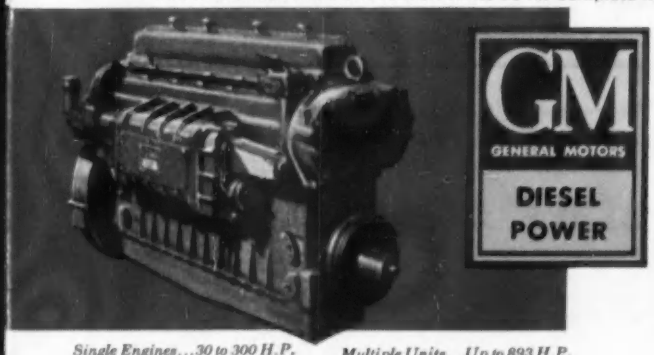
Contractor experience has proved GM Detroit Diesel power more efficient than either gasoline engines or other Diesels on almost every kind of job from 30 H.P. up. And Detroit Diesel's new Turbopower engines deliver even higher efficiency *—up to 17% more power on the same fuel, or the same work with fuel savings up to 15%!*

You're money ahead when you specify GM Detroit Diesel power in any equipment you build, buy or repower. It's America's First Choice Diesel *because it does more work at less cost!*

SEE OUR EXHIBIT AT THE ARBA ROAD SHOW, CHICAGO, JAN. 28 TO FEB. 2

Diesel in Road building ?

Equipment shown includes: Blaw-Knox MultiFoote paver and spreader; Koehring Dumptors; Cedarapids rock crusher; Link-Belt and Unit shovels; Ingersoll-Rand air compressor; LeTourneau-Westinghouse Tournapull and Pettibone Mulliken front-end loader. Write us for complete list of over 1000 GM Detroit Diesel power applications.



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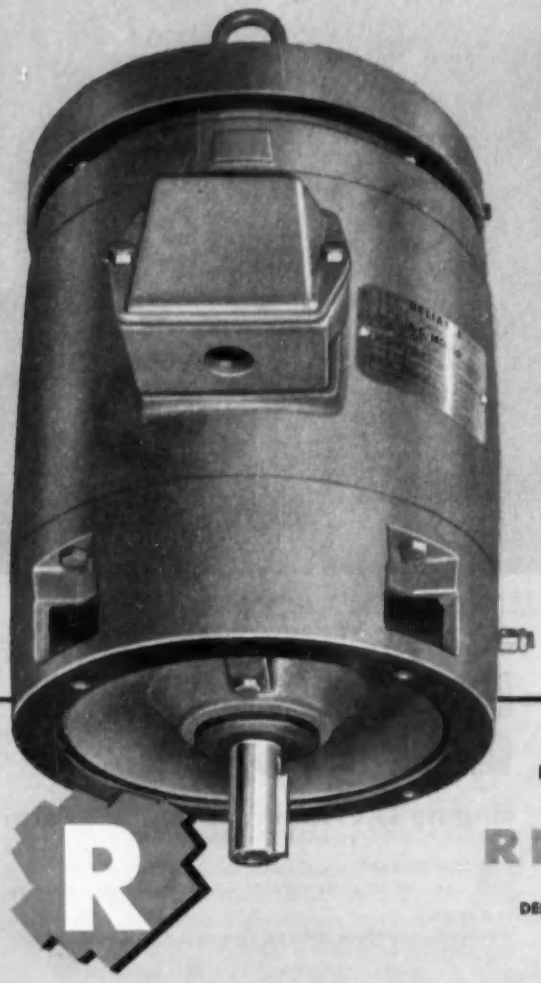
NEW RELIANCE P-BASE MOTORS

Designed for outdoor and indoor installations

THESE RELIANCE FEATURES offer you the best motor for your pump installations.



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NEW EIMCO FILTER DESIGNS PAY OFF FOR THIS CUSTOMER

In the past decade, a prominent firm has increased considerably its production of Titanium Dioxide – a pigment used extensively for paint and whitening applications from "dentures to doorknobs".

During this period, an Eimco Disc-Type Filter has been employed in the flotation process used on ilmenite concentrate.

The ilmenite flotation concentrate is 60% solids with fast settling physical characteristics when fed to the Eimco Filter. Filtered concentrate is immediately shipped by rail to other plants where it is a raw material for the production of titanium dioxide, used to whiten and brighten thousands of products.

Working in close alliance with a co-operative client, Eimco's field engineers recommended new methods that achieved high operating efficiency as production level increased.

When filtering rate was increased, the disc filter—as a result of the expansion—was taxed far beyond the production capacity it was intended to maintain. At this high production level, an ordinary disc filter was not capable of maintaining uniform particle suspension, resulting in uneven cake formation, low capacity and higher-than-necessary moisture content **(15%).**

By converting the disc filter into an Agidisc—strong, **properly directed** agitation was applied and **uniform** particle suspension was attained. The Eimco Agidisc readily handled the concentrate under process conditions imposed by this increased volume . . . produced even cake formations dewatered to **8%** moisture.

Later Eimco "Hy-Flow" Design was applied to the Agidisc. This streamlined design permits the flow of filtrate and air through the filter and valve with a minimum of hydraulic resistance. Filtering capacity has increased, vacuum loss reduced and cake is dewatered to **6.2%** moisture.

The search for a better way never stops at Eimco's Research and Development Center, Palatine, Illinois. The result is a constant flow of improvements in filtration equipment that pay off in increased production and more profit. Write today for more information.

THE EIMCO CORPORATION

SALT LAKE CITY, UTAH

Research and Development Division, Palatine, Illinois • Process Engineers Inc. Division, San Mateo, California
Export Offices: Eimco Building, 51-52 South Street, New York 5, N. Y.
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B-235

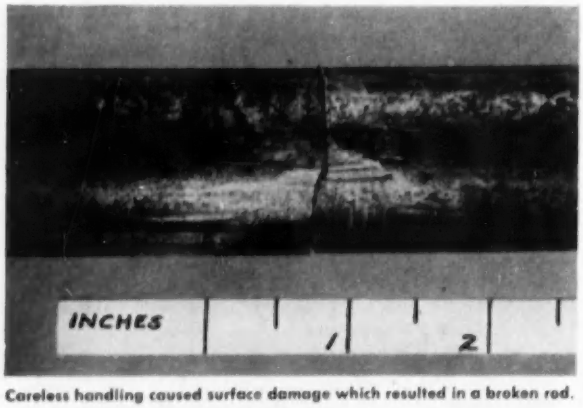
how to get the most out of HOLLOW DRILL RODS

In a modern jackhammer, hollow drill rods must take between 1800 and 2000 jolting blows per minute. It's pretty rugged treatment for *any* steel — even Crucible's special alloy CA DOUBLE DIAMOND or 4E Hollow Drill Rods. That's why it's so important that you prevent unnecessary *abuse* of drill rods on the job. Here are a few tips that may save you time and money.

Take, for example, DRILLING METHODS

ROD ALIGNMENT — A little extra care in properly aligning the drill rod so that the force of the piston is transmitted to the rock in a straight line will help reduce breakage a surprising amount. For bad alignment sets up severe stresses in the steel.

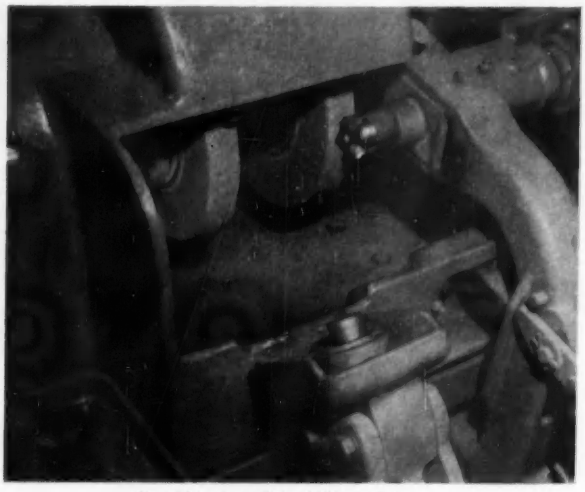
RATE OF FEED — Too slow a rate of feed forces the rod to absorb much of the impact — without a proportionate amount of hole being drilled. Too fast a rate results in a high breakage rate. Alloy rods — Crucible CA DOUBLE DIAMOND or 4E — allow faster drilling speeds than straight carbon drill rods used under the same conditions. That's because these alloy rods have higher hardness, tensile and yield strengths. The harder, more elastic alloy rod transmits the piston blow more efficiently than does the straight carbon drill rod.



Careless handling caused surface damage which resulted in a broken rod.

SURFACE DAMAGE — Damage to the surface of a drill rod may often lead to a broken rod. Nicks or deep tool marks cause stress concentration at the damaged spot.

BITS — Drilling with bits that have dull edges or gages badly worn creates a strain in the drill rod that prevents maximum efficiency. It pays big dividends to keep bits in good shape.



Sharp bits pay off in drilling efficiency.

Actually, the solution to lower drilling costs—longer drill life—is simple: First, use the *right* drill rod and, second, apply a little extra care and common sense to machine setup and operation. It's well worth the effort.

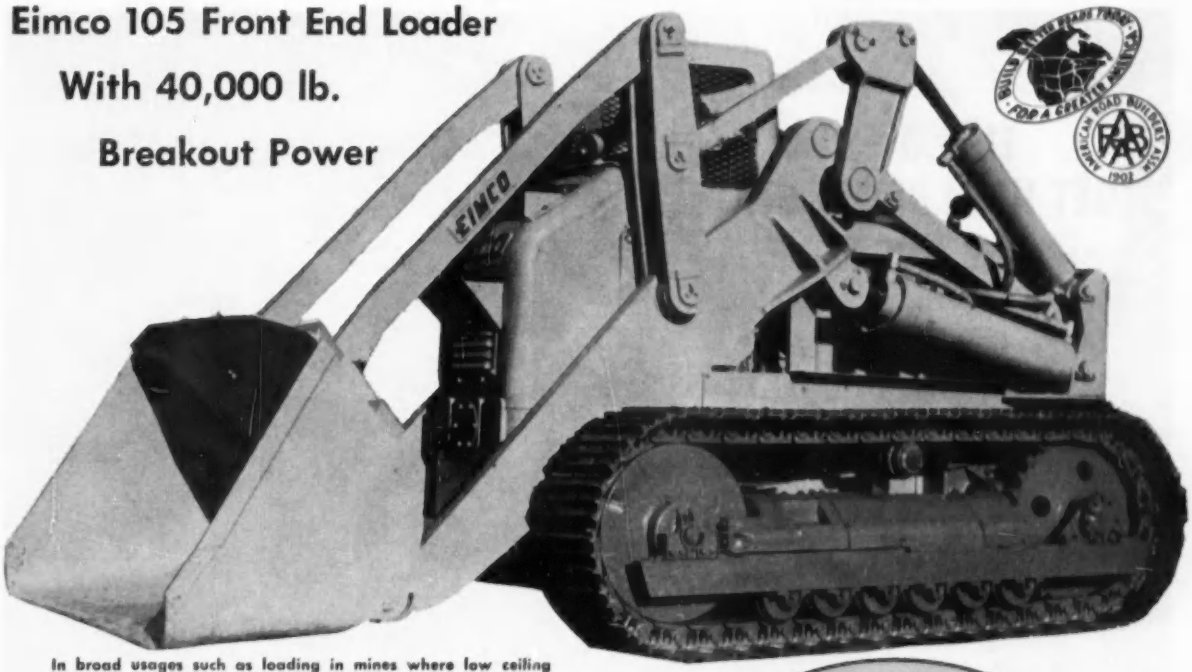
Your nearby Crucible representative can give you helpful hints on other phases of drill rod care and operation—or arrange for *prompt* delivery of hollow drill rods in the sizes, types and grades you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Circle 5A on reply card

Eimco 105 Front End Loader With 40,000 lb. Breakout Power



In broad usages such as loading in mines where low ceiling prevents overhead discharge . . . raxing brickwork in open hearth furnace slag pockets . . . cutting smooth grades where fine control is required . . . loading into haulage equipment where high discharge is necessary . . . loading into light units or handling fine, dusty and wet material where controlled discharge is desirable . . . loading around wharves, docks, railroad yards (with fork lift attachments) . . . the 105 fills industry's requirements for a rugged, extra heavy-duty front end loader.

NOW! EIMCO HAS TWO RUGGED LOADER ASSEMBLIES

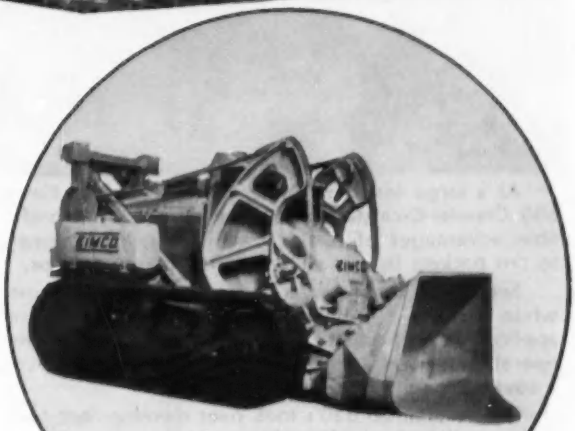
Productive scope of the Eimco 105 Crawler-Tractor has been broadened again by development of a heavy-duty Front End Loader.

For the first time, this provides the earth-moving industry with a machine that can utilize two unique loading attachments . . . each employing entirely different operating principles for jobs where physical conditions make the use of one advantageous over the other.

Since introduction of the 105, heavy construction industries in all parts of the world have praised the digging and loading speed of Eimco's rugged Rocker Arm Excavating Loader.

Like this and all Eimco equipment, the Front End Loader reflects years of constant development combining research with practical field experience.

Exclusive features of the hydraulic system provide an extra margin of protection against mechanical delays and the torque converter transmits maximum power from engine to boom and bucket cylinders for powerful digging effort at the bucket lip.



EIMCO 105 EXCAVATOR

All attachments (including bulldozer assemblies) are Eimco-built to standard SAE mounting dimensions for the basic 105 Tractor. This means that you get extra performance from every attachment through operating ease, maneuverability and visability . . . permits you to increase your earning potential without the addition of specialized machinery.

Each of these dirt-moving tools gives you new production and profit opportunities well worth investigating. Do this today by writing The Eimco Corporation for full particulars.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

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B-236

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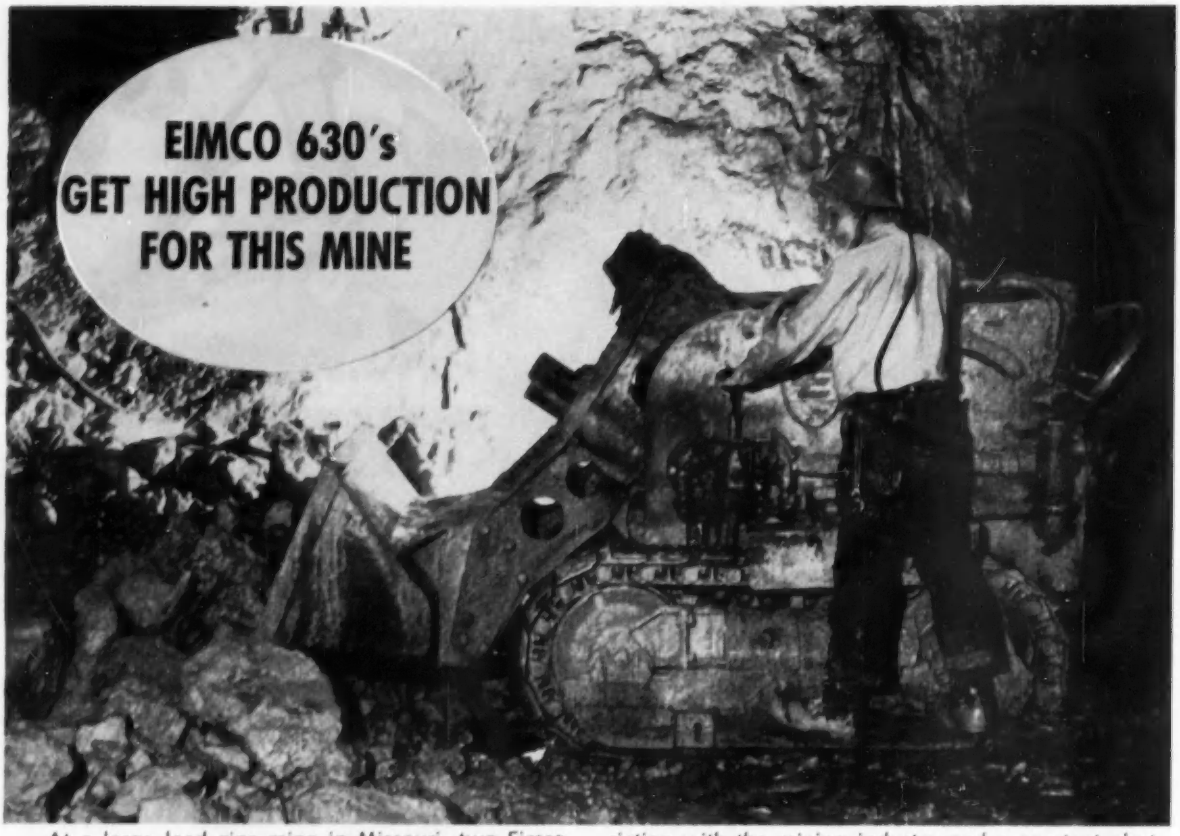

At a large lead zinc mine in Missouri, two Eimco 630 Crawler-Excavators are demonstrating the profitable advantages of trackless mining, cutting tunnels to ore pockets in a shaft 1,000 feet below surface.

Seeking to combat ever-increasing production costs while meeting a growing demand for lead in critical applications, officials of this mining firm planned the operation around a trackless system. This has proven a sound economic move.

The two Eimco 630's took over development tasks from another type of trackless equipment early this year. They have provided these results:

High operating efficiency. Sharp (independent track) maneuverability; quick response to easy-to-work levers; rugged . . . stay on the job under severe service; high mobility . . . no restrictions on movement.

Cycle time saver. The 630's can go right to work on a muck pile . . . require no preparatory measures. Powerful crowding action quickly fills the big bucket and rocker arm discharge is fast.

Lower initial investment. Cost is about one-fourth as great as that of previously used equipment.

The Eimcos are helping to make it profitable for this company to extract lead from lower grade ore.

This versatile machine was not developed overnight. It has evolved from a long period of close association with the mining industry and a constant alertness to production problems.

See the 630 in action. You'll agree, it will allow you to capitalize on expanding opportunities in an industry where volume excavating at low cost is becoming increasingly critical to a profitable operation.

Loading big trucks, this operator uses his left hand to regulate tractor movement and his right hand to control the bucket as the 630 crowds a muck pile.

B-234

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ON THE COVER

IN SOME arid sections, wind carves hard rock deeply. Perhaps taking a cue from Nature's handiwork, man produces wind and sends it through hoses to perform many useful tasks. This industrial wind is compressed air. When released suddenly, its tremendous expansive force creates a powerful blast that can be directed through a nozzle at will. Man utilizes this tornado to hurtle streams of sand and fragments of steel against stone and metal surfaces to remove every vestige of dirt and grime and leave them clean and smooth. The operator on our cover is blasting a welded section of a large Ingersoll-Rand steam condenser. The abrasive will soon enlarge the orifice in an ordinary steel nozzle, so boron carbide, advertised as the hardest man-made substance, is utilized for the service. The operator wears a protective helmet, to which his breathing air is supplied through a separate small hose entering at the back.

IN THIS ISSUE

LOGS that were felled 100 years ago and have since been submerged are being recovered and sawed into lumber in a strange timbering enterprise in Maine. Page 2.

THE International Nickel Company is launching a $175-million mining project in Manitoba that will increase its production of nickel by one-half. Two new mines are being opened and a town established. Page 4.

A MINIATURE air-operated cannon or "trainer" enables cadets to learn the science of artillery fire without leaving the armory. Page 6.

SKINDIVING is rapidly becoming more than a sport. Some of its numerous practical applications are described. Page 8.

THE second of two articles on the Caterpillar Tractor Co., reveals some of the ways in which air power serves the production lines. Page 12.

Compressed Air Magazine

VOLUME 62 **January 1957** NUMBER 1

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Aquatic Lumberjacks

V. H. POOLER*

AMPHIBIAN TOILER

Like the U.S. Marines, the "Duck" serves on land or sea. In the lower picture a diver is shown boarding the Pooler craft after having located and secured lines to several sunken logs. A marker buoy is floating near the left end of the boat. The "Duck" is shown at the top as a land cruiser.

RECALLING the pioneer days of the State of Maine, one visualizes the thousands of lumberjacks who entered the great woodlands each fall to cut virgin timber. In the mid 1800's, Bangor, then lumber capital of the world, was the hub of those activities, especially when the logs felled during the winter months were floated down the big Penobscot River in spring "drives." The lumber was used in Maine's many shipbuilding yards or shipped far and wide at home and abroad. Many a story has been written about this robust era.

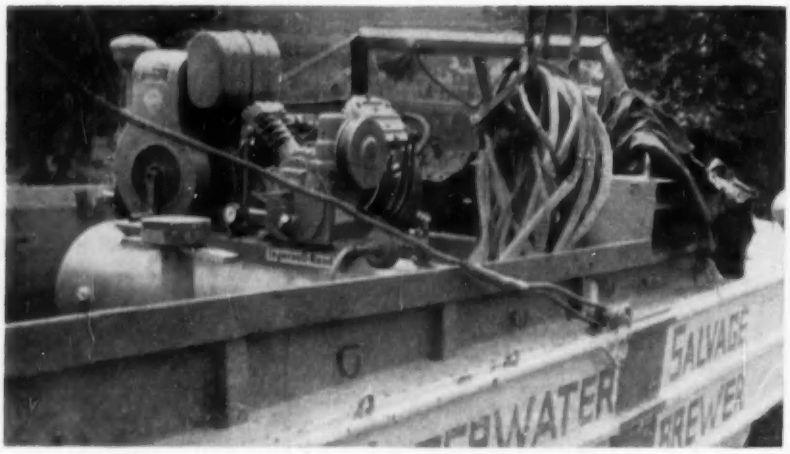
A century later, Bangor once again is talking about timber, but this time about timber that is being harvested in a most unusual manner by the R.M. Pooler Underwater Salvage Company. The odd part is that much of the lumber is the very same cut down by Maine woodsmen before the advent of the crosscut saw. This is not the story of a big business but rather of a new industry that was born with the aid of modern equipment and whose future is not yet clearly defined. However, after only one month of exploratory operations many thousands of board feet of rough-cut lumber has been salvaged and delivered to satisfied customers.

Robert Pooler, a 24-year-old ex-Navy deep-sea diver with previous experience as a tree surgeon, decided to explore stories oft-repeated by old woodsmen that underneath the river were deposits of logs which, for various reasons, had sunk on their way to the mills. It took just one dive to settle the truth of the tales. Embedded in the mud and silt were huge logs remarkably preserved after about a century of submergence.

A Navy surplus "Duck," a large amphibious truck equally at home on land or water, is the working base on which is mounted an Ingersoll-Rand T-30, 5-hp gasoline-driven air compressor. Operating at 100-psi pressure, it supplies sufficient air for up to five divers at one time and also serves to inflate pontoons, when necessary, and to run chain saws.

Actual salvage work begins when the Duck ventures into the water. By shifting gears, the main drive engages and turns a screw impeller between the rear wheels, thus changing the craft from land to water operations. Diving starts when an anchor has secured the vessel. Then there is a need for a reliable source of compressed air. One or two divers go down to depths ranging from 20 to 30 feet in the lakes and up to 90 feet in the river. They search around on the bottom, often groping in several feet of mud. Upon locating a log, they tie on a line attached to a buoy on the surface. After some 20 to 30 have been made fast in an hour, the Duck with its winch and special boom located aft tows the logs to shore and right up on the ground where the boom loads them on a truck that will

*The author is a brother of Robert Pooler, but is not identified with the operation described.



A DIVER'S BEST FRIEND

A compact, engine-driven compressor aboard the "Duck" furnishes oil-free breathing air to the diver as he prowls the bottom looking for long-hidden logs.

take them to the sawmill. The Duck then returns to the water for another "catch."

Before my interview with my brother there were several things about the business that puzzled me. To my question, "Who owns the sunken logs?" he answered, "After a period of time they're the property of the salvager." When asked, "Why did the logs sink?" Robert answered: "A cut end might have become waterlogged and sunk. Or, an end somehow got stuck in the mud and eventually became waterlogged. Hardwood with a specific gravity twice that of softwood (oak 0.87 and pine 0.45 based on air-dry wood) was cribbed with softwood to allow it to float better. Drilled holes with wooden pegs inserted was evidence of the way the cribs were held together. Occasionally this cribbing would break loose and the hardwood would be lost. In the course of almost 100 years of great lumbering activity there were bound to be such losses."

It is difficult to believe that these reclaimed timbers are still usable. However, they are in excellent condition and retain their shape after drying, especially as there is no sap or pitch to cause warping. My brother believes, and several old-time lumbermen agree, that it is choice wood. It has very few knots and a beautifully aged appearance. Different kinds of wood including birch, oak, maple, ash, pine and spruce have been salvaged. Many of the logs are 15, and some as much as 30, inches in diameter and 20 to 40 feet long. Generally they have brand marks and cut notches identifying the particular lumbering company which felled the timber. These brands were necessary because all lumber was floated together and caught by buoys with logs strung across the river at Bangor. The logs had to be sorted by lumberjacks who ran on them and jumped from one to another with great agility, pushing them with long poles. This activity brought about the log-rolling contests so popular at sports shows.

FRUITS OF LABOR

Lumber sawed from trees chopped down a century ago is stored in the open. Most of the pieces in the foreground are 2x11-inch hardwood planks.

Robert remarked on the absolute necessity of reliable air-compressor operation while the divers are underwater. He wanted Ingersoll-Rand's T-30 because of his experience with them while engaged in such subaqueous work as raising aircraft sunk off LaGuardia Field and in Chesapeake Bay and recovering the bodies of many victims of water accidents. The T-30 compressor is lubricated either with castor oil or an oil meeting Navy diving specifications to insure against toxic vapors. Special filters keep the air clean.

At first, softwood was taken from the Penobscot, but now it seems that hardwood found in lakes may become more profitable. Hardwood is more abundant there because it was easier to crib the logs in quiet water, as compared with the turbulent river. Before the advent of good highways, Maine's trees were cut down in large areas around lakes and floated to sawmills on shore. Evidence of the remains of an old sawmill is sufficient to begin exploratory diving. Present plans call for the erection of a portable sawmill on the lake being worked. When that site is abandoned for another one, the mill will be moved and reassembled. With its own mill, most of the loading operations will be eliminated.

Today, salvaged lumber is being sold on an ungraded basis because stocks are not big enough and some revenue has to be available. Approximately 30,000 board feet has been stacked for drying. After the stock has been sufficiently enlarged the lumber will be sorted and graded, thereby bringing a better price.

An interesting sidelight of the business is that historians periodically approach the company about retrieving articles from Maine waters. Currently there is much interest in a fleet of ships which was sunk near Bangor during the French and Indian War. The Duck is always kept ready for any emergency. It is fully equipped for deep-sea diving. Should a diver be needed, the only delay would be travel time on the highway.

So, when next you're vacationing in Maine and see a big red-and-silver craft with an anchor drive past you, don't be alarmed! It is just the R. M. Pooler Underwater Salvage Company on its way to new operations.

LOTS OF PULL

The powerful "Duck" churns the water as it dislodges a log mired in the mud near shore.

New Nickel Mines Projected

International Nickel Company Announces Huge Development Program in Manitoba

ALLEN S. PARK

MAIN EXPLORATION CAMP
Headquarters of International Nickel's field staff at Moak Lake (left). The light patch in the center background is the site of the Moak Mine exploration shaft. It is shown at closer range above together with buildings and oil tanks

PLANS for a $175-million development of new nickel mines and complete ore-reduction facilities in the northern part of the Canadian province of Manitoba during the next three or four years were announced on December 5 by Premier Douglas Campbell of Manitoba and Henry S. Wingate, president of The International Nickel Company of Canada, Limited. International Nickel will open two mines in the area, which is about 400 miles north of Winnipeg. Aside from the operations at Sudbury, Ontario, where Inco has been established since 1902, the new properties will perhaps become the largest nickel producers known. They are expected to yield annually approximately 130 million pounds of it, or 50 percent of the company's current output.

The development will include the establishment of a new town which, like one of the mines, will be called Thompson, to honor Dr. John F. Thompson, chairman of Inco's board of directors who completed 50 years of service with the company in 1956. It will also include a hydroelectric power plant to serve the mining area. To be located at Grand Rapid, 50 miles away on the Nelson River, it will be constructed and operated by the Manitoba Hydro-Electric Board. To help finance its estimated cost of $32 to $38 million, Inco will lend the province $20 million for 4 years, after which time the loan will be converted to debentures that will be retired over a period of years. Manitoba has long wanted to develop this power site and the new plant will have surplus capacity with which to supply other needs than Inco's as Northern Manitoba acquires additional industries.

The Canadian National Railways line between Winnipeg and Churchill on Hudson Bay passes within 30 miles of the new mining area and a connecting link will be built. In addition, Inco will construct a 20-mile line to join the two mines that are projected and the new townsite about midway between them. In order to get the program under way immediately, Inco will supply funds for all of the initial construction but expects to be reimbursed ultimately for the power plant and railroad expenditures. According to President Wingate, the company's capital investment will be approximately $115 million, exclusive of the cost of the railroad spur, the power development and about $20 million for the townsite construction. Plans will be made for a town to accommodate an initial population of 8000, including the expected working force of 2000. Provisions are to be made whereby employees can own their own homes with financial assistance from Inco and through provisions of the National Housing Act.

The decision to proceed immediately with the development means a major saving in time, Mr. Wingate points out. A month's delay would preclude hauling in much of the heavy equipment needed over the ice by tractor train this winter and thus postpone the program for a year. It is planned to begin production of nickel in 1960. It is unofficially reported that between 8000 and 12,000 tons of ore will be mined and concentrated daily.

As a part of its world-wide search for more nickel deposits, Inco began investigations in Northern Manitoba 10 years ago and has so far expended about $10 million there. Its attention was directed to the area by a find made by a trapper-prospector at Mystery Lake. The ore there was not rich enough to be commercial and examination of the surrounding country revealed no further surface indications of mineralization. However, airborne geophysical investigations produced evidence of deposits that were later found by surface prospecting.

All told, the company has partially explored a strip of land from 5 to 10 miles wide and 80 miles long. The two mines so far outlined are the Moak and the Thompson, the former north of Mystery Lake and the latter south of it. A development shaft 1300 feet deep has been sunk at the Moak but at the

LOCATION MAP

Where two new mines, a smelter, refinery, power plant and completely equipped town for 8000 will take form. At Lynn Lake, near the Saskatchewan boundary, other nickel deposits are being worked by Sherritt-Gordon Mines.

DIAMOND DRILL AND PLANE

A core drill is shown (above) during a visit of members of the Manitoba Legislature. Eighteen of these rigs are currently working in the area. At the left supplies are shown being unloaded from a plane to a tractor-sleigh on a lake near the exploration camp.

Thompson the only underground probing has been done with diamond drills. The Moak ore body is described as 800 feet wide and from 4000 to 5000 feet long. The depth has not been determined, as drill holes 2000 feet deep are still in ore. The limits of the Thompson deposit are yet to be defined. It has been drilled over a length of 15,000 feet and no hole has failed to disclose ore. It narrows down to a width of 10 feet in some places, but generally runs 100 feet and in some places 200. Sampling indicates that the Moak ore averages from 0.6- to 1- percent nickel, whereas the Thompson runs considerably higher. It is expected that the two will be mixed to produce a grade of around 1.5 percent for beneficiation.

The new ores are of the sulphide type, much like those at Sudbury. However, they carry practically no copper content which, at Sudbury, is about equal to that of nickel. Inco's copper-producing capacity will accordingly not be increased by the new program. Minor quantities of cobalt, platinum, palladium, gold and silver are present in the Manitoba ores though and will help make the project financially successful.

Eighteen diamond drills are operating in the Mystery-Moak lakes area seeking to learn more about the extent of the deposits. About 235 men are employed. Because of the great amount of capital being risked, Inco has been given a 63-year lease on the ground it is holding and this will be subject to renewal at 21-year intervals.

Announcement of the undertaking is important to the United States, which has been stockpiling nickel for several years at a high rate because of its strategic value. Not only has Uncle Sam been taking large quantities from Canada but also the full output of newly developed mines in Cuba.

Canada currently produces about 81 percent of the free world's nickel and the Manitoba program will increase this proportion substantially. Of 427 million pounds produced in 1955, Canada contributed 352 million, which was a gain of 40 million pounds over 1954. Of the Canadian total, International Nickel accounted for 285 million pounds, Falconbridge Mines 42 million and Sherritt-Gordon Mines 25 million. Inco operates five mines at Sudbury with fourteen operating shafts and some 400 miles of underground workings.

Development of new uses of nickel, coupled with heavy withdrawal of supplies for military stockpiles, has created a growing shortage of the metal in recent years and industries, especially in the United States, have been hard pressed to obtain their requirements. The price advanced from 32 cents per pound in 1938 to 63 cents in 1955 and Inco announced an increase to 74 cents (U.S. funds) on December 5, 1956. It is reported that nickel has sold in the black market for as much as $2 per pound in recent months.

The outlook is that both production and price will continue to rise and there are some predictions that output of the free world will approach 1 billion pounds by 1960.

The production of nickel also makes Canada the leading source of the platinum group of metals, which are recovered as byproducts. The Sudbury district alone yields about $22.5 million worth of them annually.

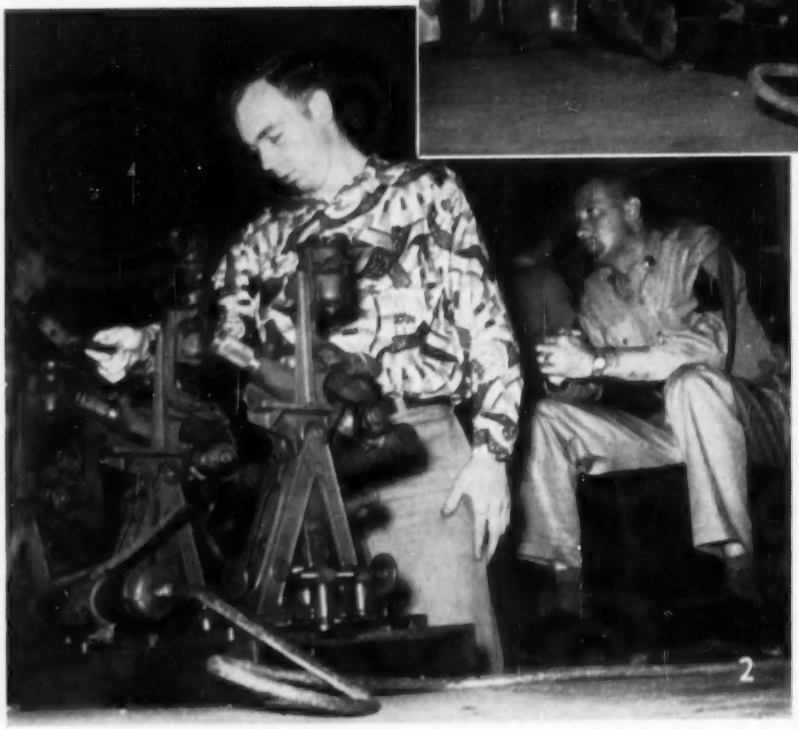
Indoor Artillery Practice

Photographs and information from Harold Stickler, Ames, Iowa.

THE miniature field pieces shown are Bishop trainers, used to prepare artillery cadets for the real thing. This device uses compressed air instead of powder and fires a steel ball 1 inch in diameter and weighing approximately 2½ ounces. The weapon corresponds, in scale and operation, to 105-mm and 155-mm rifles and has the same instrumentation as they have.

The trainer became standard equipment at the United States Military Academy at West Point, N.Y., before World War II and has since been adopted for teaching purposes in the Reserve Officers Training Corps at various colleges. Even some of the training centers in Korea employed it for preliminary instruction. The Navy has a different training weapon—one that fires only invisible electronic rays and shows "hits" and "misses" with different colored lights.

Although these pictures show the trainer in service in the armory at Iowa State College, Ames, Iowa, it can be and is sometimes used outdoors where windage is a factor. ROTC training is compulsory at the school during the first 2 years and optional thereafter. The training program is in charge of an Army commissioned officer who holds the faculty post of Professor of Military Science and Tactics and there are several noncommissioned officers on the staff.



1 **SIGHTING.** The student looks through a periscope-type sight and makes adjustments calculated to land the projectile where he wants it to go. An air hose in the foreground leads to a manifold from which other lines take off to each of the four trainers. At the most used range of 60 yards, which is equivalent to 6000 yards with an actual field piece, the air pressure is regulated to 70 psi. The student at the telephone at the left receives reports on the accuracy of the fire from observers at a forward position.

2 **FIRING.** The trainer is equipped with a push-button firing device, but to insure positive action, it is usually fired by striking the valve handle a sharp blow with a small hammer as shown. This admits a blast of air that propels the steel pellet through the short barrel. At the right is an instructor, an Army master sergeant.

3 **TARGET.** A large canvas relief map, complete with roads, bridges, hills, streams and even an airfield (upper right) is laid on the dirt floor at the far end of the armory from the firing station. It's all calculated to scale.

4 **OBSERVERS.** These men are stationed about 20 yards forward of the firing point at the rear wall. With field glasses trained on the target, they watch where the pellets land and report by telephone so that adjustments may be made at the gun as required to obtain greater accuracy.

SKINDIVING GAINS STATURE

Industries and Treasure Hunters Turn to Technique Originated by Sports Devotees

ROBERT JAMES

AIDING CONSTRUCTION

Checking the accuracy of bridge blueprints was a big part of a skindiver's job on a New York subway extension. Power, control and signal cables were laid underwater along bridges crossing Jamaica Bay. Fischbach & Moore, Inc., electrical contractors, give the skindiver credit for making it possible to complete the work on time despite adverse conditions. The cables were laid 25-feet below the surface of the bay.

CURIOSITY—the urge to see and do something new—was probably the principal reason why skindiving with self-contained breathing apparatus gained so many adherents in the first few years after the equipment became available. We reported the growing use of underwater breathing aids in an article (*Compressed Air Under the Waves*) in the August 1953 issue and told something of the lure of Neptune's domain. At that time about the only device on the market was the Aqualung made by U.S. Divers Company to the specifications of its originator, Captain J. Y. Cousteau.

The growing popularity of skindiving is attested to by the entry into the field of other manufacturers, chief among them being Scott Aviation Company with its Air-Pak and the Garrett Corporation with its Air Lung. All three apparatus are enjoying brisk sales and have not only stimulated the purchase of a variety of other equipment but also spurred on some enthusiasts to make diving accessories and even lungs to their own specifications.

Reports from Italy describe a submarine for more venturesome skindivers. Fifteen feet long, the 2-passenger craft has a range of 60 miles, a top speed of 8 knots and can submerge to a depth of 60 feet. The latter limit is imposed by a snorkle or breathing tube for the vessel's 9-hp internal-combustion engine. The sub has a pair of ballast tanks which can be flooded to achieve negative buoyancy and carries a "canned" supply of compressed air that is used to empty the tanks to surface. Separate breathing aids are worn by the divers and enable them to leave the craft and go exploring, if they wish. The buoy which supports the snorkle serves as a marker for the submerged vessel. If the latter should be "lost" while the divers are investigating the deep, all they have to do is surface, locate the buoy and follow the snorkle tube back to the submarine.

An ingenious Aqualung user, a Miami, Fla., spear-fishing enthusiast, made his own carbon dioxide-powered spear, reports Walter Kidde Company, from one of its 2½-pound fire extinguishers. By using a 90° angle fitting as an adapter he attached a shoulder stock to the trigger-handle and replaced the nozzle assembly with a length of tubing (the "barrel"). Triggering the release valve on the extinguisher-gun releases CO_2 under high pressure into the tube and propels the muzzle-loaded spear with great force. About 50 shots can be fired before the supply of carbon dioxide is exhausted. The extinguishers are readily available.

Man isn't only a hunter when he goes skindiving: sometimes he's the one that is hunted. In some parts of the world man-eating sharks have been known to

WIDE WORLD PHOTO

LOCATED ILL-FATED SUNKEN VESSEL

The Gimbel Brothers, David, left, and Peter, skindivers from Bridgehampton, N.Y., who went down in 250 feet of water on July 28 and located the hulk of the "Andrea Doria" which sank after colliding with the "Stockholm." Reporter Bob McKeon of the "New Bedford (Mass.) Times," who went on the trip, is in the left background, Mrs. Peter Gimbel is in the center and Capt. W.E. Ellis of the charter boat is at the right. Another skindiver, Joseph Fox, participated, but is not in the picture. Visiting sunken hulls with aid of 'lungs has become a favorite sport of many divers. Some subaqueous salvage work also has been accomplished.

get voracious, although most reports of "attacks" can be laid to curiosity on the part of those finny denizens of the deep. Along the Great Barrier Reef of Australia, however, they claim several victims each year, and organized antishark patrols are maintained around beaches. Six young Australian skindivers are betting that a U.S. Navy report to the effect that ultrasonic underwater signaling apparatus will repel sharks is correct. They are literally putting their skins on the block by offering themselves as bait to test the equipment developed by a joint government-private club committee on shark defense. They hope that the experiments will result in a device that can be anchored by a buoy near beaches and will effectually chase the man-eaters from a wide area.

In this country an electronics engineer from Hollywood, Calif., has invented an electronic prod which, it is claimed, will chase away any large fish which gets too close for comfort. Snoopy sharks, barracudas and morays—savage eels—are the skindiver's chief worry, but the prod is reported to send them all swimming for cover.

Skindiving for profit is a growing field. Self-contained apparatus are suitable for many applications that previously required a fully rigged diving suit with a surface air supply. Indeed, in some cases they are better. Last year in Florida the installation of a sewer pipe for the Coral Way Village housing development was completed by skindivers after three other contractors had failed in their efforts to finish the job.

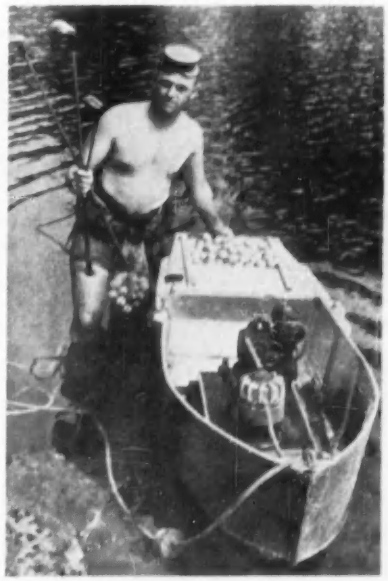
Water tables in Florida are frequently only inches below the surface, and the one beneath Coral Way Village was no exception. Trenches became filled with between 6 and 9 feet of water, and all attempts to dewater them failed. The fourth contractor just let the trenches fill and hired a group of skindivers to lay the clay pipe. Seven 3-foot lengths were connected at the surface and lowered into the trench as a complete section so as to reduce the number of joints which had to be made underwater. The latter work was done by expanding hollow rubber seals with grout.

On another job a skindiver materially aided an electrical contractor placing 45,000 feet of subaqueous power, signal and control cables at the North and Beach Channel bridges across Jamaica Bay for a New York City subway extension. It was his responsibility to spot obstructions, to determine where the cable had to be cut to provide proper lengths and how best to mount the cable cleats along the bridges.

Nine young divers, all graduate geologists—three of them with Ph. D.'s—have organized Geological Diving Consultants, a mapping and prospecting firm with headquarters in San Diego. They've been at work for about two years and have made thousands of descents, mostly at depths of about 50 feet, along the California coast on assignments for oil companies. Their activities consist largely of confirming results of seismographic tests and straightening out any misleading observations obtained by that method. The divers wear neoprene suits over heavy woolen underwear to stay warm and comfortable in the 52 to 54°F water.

One way to make money out of golf is to be a top-notch pro; but Joseph Bishop of Miami found another way which involves skindiving. Equipped with a demand regulator and mouth breathing device supplied with air by a small surface compressor he explores the bottoms of creeks and ponds on a local course. He retrieves balls by the netful and even a few clubs. Driving ranges and golfers buy his finds—he himself doesn't play.

Just off Long Island a group of skindivers are pursuing a profitable sport in examining old wrecks. They derive great pleasure in locating old hulks that have never before been visited by human beings. The group is made up largely of amateur divers, and even some high-school boys are included. The wrecks are at depths of 50 to 75 feet, and are spotted by examining the ocean floor with a fathometer after determining the



GOLF-BALL SALVOR

A small air compressor, a length of hose and a demand-regulator feed air to Joseph Bishop, who searches for lost balls in a creek at a Miami, Fla., golf course. He even comes up with a few discarded clubs now and then. The boat carries the equipment and also is a repository for retrieved treasure, which he sells to driving ranges or back to the club members. Bishop, himself, has no need for his finds—he's not a golfer.

approximate site from Coast Guard archives, old-timers' tales, etc. Their base is a fishing schooner, which ordinarily uses the fathometer to detect schools of fish.

Catering to this group of aquatic fortune hunters, an organization in Spokane, Wash., calling itself Treasure Associates, ran advertisements in western mining publications offering maps at from $1 to $3 each purportedly showing locations of more than 550 sunken vessels that had $200 billion worth of gold, silver and other valuables aboard when they foundered. The advertisement stated that recoveries by skindivers and others have totaled between $10 and $15 million annually. More recently other young skindivers made headlines by visiting the sunken *Andrea Doria*, the ill-fated Italian liner which went down after a collision with the S. S. *Stockholm* on July 25, 1956.

In any occupation or avocation there are always a few individuals who try to reap profits illegally, and skindiving has its share of them. For example, along the Netherlands-German border Dutch police foiled an attempt to smuggle coffee from their country. Had the enterprise been successful, the crooks would have made a good haul because of Germany's high import tariff on coffee. Before being nabbed, three divers equipped with 'lungs made three fruitless efforts to swim across the border through canals which penetrate it at frequent points. Twice—the first and last tries—the

"So help me—this is the last time I'll ever work for a skindiver!"

smugglers ran up against underwater obstacles. The second time the milkcans containing the contraband refused to sink—floated on the surface. At the last attempt, which failed because of the obstructions, the crooks hid the coffee in an adjacent field where it was found. The police awaited them there when they returned for it.

Although free-swimming breathing aids are used for nefarious purposes, they are also available to law-enforcing agencies. This year in Novarra, Italy, for example, three skindivers painstakingly examined Lake Orta for clues to the wartime slaying of U.S. Army Major William Holohan, an O.S.S. (Office of Strategic Services) agent. The New York city police department has recourse to the equipment, as well as other law-enforcement agencies in waterfront cities the world over and governmental intelligence and counter-intelligence departments. The February disappearance of England's Commander Lionel Crabb while allegedly examining hull characteristics of a Soviet cruiser anchored in London harbor made headlines.

Less adventurous—and dangerous—sport may be had by confining one's skindiving exploits to examining fish and sunken vessels, and it does not involve a large investment. A good set of underwater breathing gear retails for about $125; a rubber suit, face mask and flippers for from $35 to $90; and other paraphernalia, none of it absolutely necessary, from a minimum of one dollar to around $3200 for the 2-man submarine described. A "bottle" of air at the requisite 2000 psi pressure costs approximately $1.50 to $2 and is generally obtainable at resorts (See *Selling Compressed Air for Breathing*, March 1955 issue). Even getting to good diving spots is not so expensive as it once may have been, for one New York City travel agent has advertised a week-end of diving at a center on Block Island for $50. The rate includes plane transportation, meals, lodging, etc. Fresh-water diving in rivers and lakes also has gained many adherents.

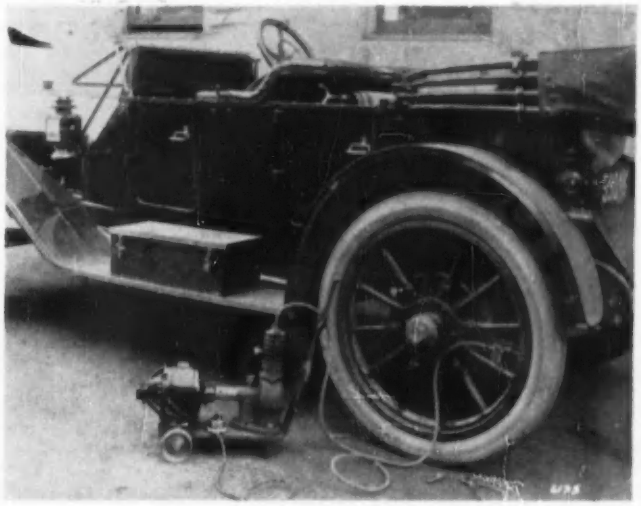
WIDE WORLD PHOTO

SHARK HERDER

This shark, which got a little too curious about the strange invader of its domain, is being directed elsewhere by a skindiver with the aid of an electronic prod that emits waves distinctly unpleasant to the shark's sensitive system. A much larger ultrasonic device is being tested by divers in Australia who hope to find a means of keeping huge man-eating sharks away from swimming-beaches. Some scientists are trying to develop a sonic device that will do just the opposite—that will attract fish so that they can be studied more closely.

TIRE INFLATION IN 1913

Although most motorists were then pumping up their own tires, this 1-cylinder garage compressor was shown in an Ingersoll-Rand catalogue printed in 1913. It was driven, through a coupling, by a 110/120-v motor using either alternating or direct current and the whole unit was mounted on a wheeled base having a pulling handle attached. It came with 6 feet of air hose and 20 feet of "lamp cord" for plugging into the nearest electrical outlet. Note the starting switch on the truck frame, the grease cups on the compressor and the air gauge at the discharge end of the hose. The make of car is uncertain. Characteristic features are the carriage-type lamps and top, the tool chest on the running board and the wooden spoked wheels. The tire was a "Goodrich Quick Detachable" of 35x4-inch size.



Automobile Cavalcade

THE automobile show in New York last month focused attention on the motor industry, truly a modern colossus. All told 160 million cars have been built in America and today we have more automobiles than families. The new models each year consume a quarter of the steel output, two-thirds of the rubber, one-fifth of the nickel.

Although the motor plants employ only 740,000 persons, it is estimated that one worker in seven owes his paycheck to the automobile. They include auto sales and service personnel, truck, taxi and bus drivers, employes of tire, battery and accessory manufacturers and of the huge petroleum industry, highway builders and maintenance crews and so on.

According to the Automobile Manufacturers Association, there are 276,613 new and used car dealers, gasoline service stations and tire, battery and accessories outlets. A good share of them have at least one air compressor.

Seven of every ten factory workers in industrial areas drive to work. Last year autos and trucks consumed 47 billion gallons of motor fuel. Car makers have spent $10 billion on new plants and equipment since V-J Day. General Motors Corporation alone buys $6 billion worth of materials each year from 21,000 suppliers. Taxes and license fees paid on cars each year aggregate $7 billion.

A glance at the two pictures on this page will remind anyone of how far motor car design has advanced in a few decades. One of the big changes on most cars this year is the shift to a tire 14 inches in inside diameter. In 40 years the size has gradually been reduced from 35 inches. As the new tires are about 10 percent wider than the 15-inch size previously standard and with more tire area touching the ground at a given instant, the air pressure can be reduced to around 22 psi. The changeover has cost tire makers millions for new tools, dies and other equipment.

The first air springs on a passenger car appear this year on the Cadillac Eldorado Brougham, and other cars may be expected to follow this lead in years to come. An air spring unit, consisting of an air dome, rubber diaphragm, retaining plate and piston, is mounted at each wheel. The piston and diaphragm fit into the dome, which is secured to the frame. Air in the dome, acting on the diaphragm, serves as a spring. Leveling valves control the flow of air to each unit to keep the car at a constant height above the wheels regardless of changes in loading. The rate of leveling action is regulated to maintain smooth riding and a "lockout" valve blocks air lines for wheel changing or parking. Air is supplied by a motor-driven compressor and stored in a receiver at 100-psi pressure.

The air spring came from buses and trucks, which have pioneered in such improvements as power steering and braking and automatic transmission.

Being refined for future introduction and about 10 years away according to some engineers, are two new kinds of power plant—the free-piston engine and the gas turbine. The compression of air enters into the operation of both of them.

PHOTO, CAREY HOLBROOK

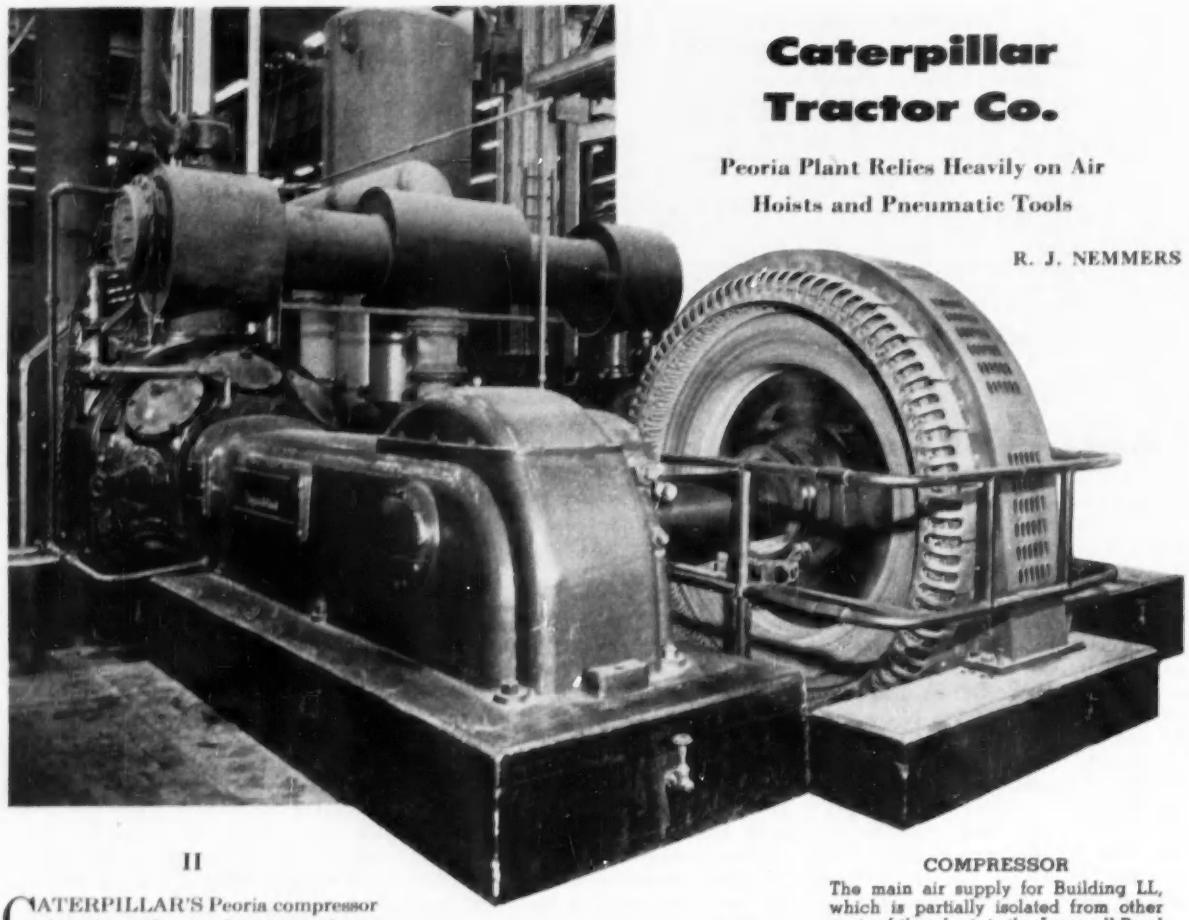
HOMEMADE SPEEDSTER OF 1902

This machine, owned by Mrs. Walter L. Miller of Santa Fe, N. M., was hand built by her late husband 55 years ago. He took the engine and differential from a Stanley Steamer and bought the wheels from Montgomery Ward & Company but made the rest of the parts and assembled them. The unusual thing about this vehicle was that it burned coal, which was chosen instead of oil largely because it is plentiful in the Santa Fe area. The Millers drove the car for several years and made trips of up to 30 miles. Enough water was carried to run for about 50 miles and when it was gone more was usually taken from a wayside stream.

Caterpillar Tractor Co.

Peoria Plant Relies Heavily on Air Hoists and Pneumatic Tools

R. J. NEMMERS



II

COMPRESSOR

The main air supply for Building LL, which is partially isolated from other parts of the plant, is the Ingersoll-Rand Class PRE compressor shown. Driven by a 700-hp Westinghouse motor, the machine has a rated capacity of 3330 cfm. Building LL, however, is tied in with the main plant system and in emergencies can be supplied from another station.

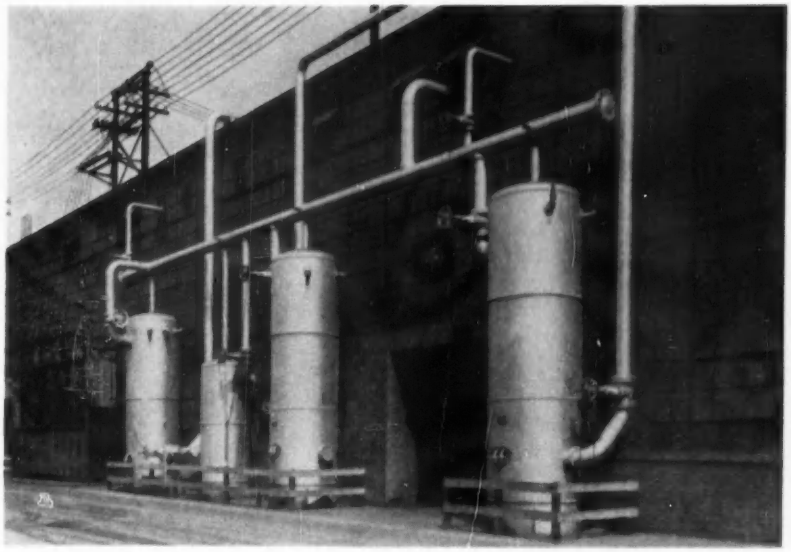
CATERPILLAR'S Peoria compressor plant is made up of an even dozen machines divided among five stations. All are tied together by the extensive air-distribution system running throughout the factory, which has a total of eleven air receivers. There are five compressors in the station housed in Building HH: two of 975-cfm capacity which are belt driven by 200-hp General Electric induction motors; one 850-cfm machine powered by a 175-hp G. E. synchronous motor; and two rated at 3330 cfm which have 700-hp G. E. synchronous drives. Three are installed in Building X: a 300-hp, 1450-cfm unit and two 700-hp machines rated, respectively, at 3330 cfm and at 3370 cfm. All three drivers are synchronous motors of General Electric manufacture. In Building KK are two 3330-cfm compressors operated by 700-hp Westinghouse synchronous motors. Building LL houses one of like capacity also powered by a Westinghouse motor. A 3160-cfm unit that is driven by a 600-hp Electric Machinery Mfg. Company synchronous motor is installed in Building EE.

The compressors, with a combined full load capacity of 30,760 cfm, are equipped with aftercoolers. Mill water obtained from the Illinois River is circulated through all cylinder jackets and aftercoolers with the exception of the machine in Building EE, which is served by a cooling tower. Nine of the units are of Ingersoll-Rand make and have a total capacity of 25,440 cfm. The compressors are of varying ages, and of the twelve in use today one installed in 1917 and another in 1918 (the two 975-cfm machines in Building HH), are in operation only during peak-load periods. Three more were set up during the boom time of the late 1920's, and two were added in 1936 to help in the manufacture of Cat diesel tractors. The eighth unit was obtained in 1941 and four have been installed since the war. Of the latter, all I-R's, two were purchased in 1946, another was hooked up in 1948 and the last one was put in service early in 1956.

The compressor stations are attended by "roving" operators—utilities department personnel who visit each one at least twice every shift. Their routine includes checking pressures, volumes, lubricating-oil delivery and air and coolant temperatures. Automatic safety switches guard the machines against loss of oil and water, as well as excess temperatures, etc. Output is automatically regulated, all the units being provided with stepped clearance control. Careful records of the output are kept, Fischer & Porter Company Flometers being installed at each station (two in Building HH; one each at the others). Each Flometer is equipped with a built-in compensator which makes sure that measurements of air at different temperatures are comparable. All measurements are indicated in cubic feet of free air.

April of last year may be taken as an "average" month to give some indication of the volume of air used in the plant. During that period 713,389,800 cubic feet of air was consumed, or approximately 24 million cubic feet per day. Actually, about 29 million cubic feet is required during an average weekday and around 12 million on Saturdays and Sundays.

As big as the Caterpillar Peoria compressor plant is, it is not an end in itself. It is only in the ways in which compressed air is used that the value of all the equipment can be measured. It takes just a glance overhead in any of the manufacturing bays or along an assembly line to find one of the biggest and



RECEIVERS

Installed outside to save space and promote better cooling of the air, the receivers shown store the output from the 5-machine compressor station housed in Building HH. Intake air filters for the units are located on the roof.

most important air applications in the factory. More than 2500 pneumatic hoists are installed there, and they are used at practically every stage of manufacture. They range from 250 pounds to 5 tons in capacity. Most of them are makers' standard hoists and are built for utility lifting and positioning jobs.

Caterpillar tool and production planning engineers prefer air hoists because they can be regulated more closely than those operated by electric motors. Unless special equipment is furnished for the latter type of drive, all hoisting is done at one speed, whereas air-motor hoists may be run at top speed, or the wind-up may be slowed to a mere crawl. The load may be raised or lowered in extremely fine increments, thus facilitating spotting of assemblies and lessening operator fatigue. In addition, pneumatic hoists are less susceptible to damage from the dust and dirt of industrial applications than their electrically driven counterparts, and they cannot be injured by motor-stalling overloads.

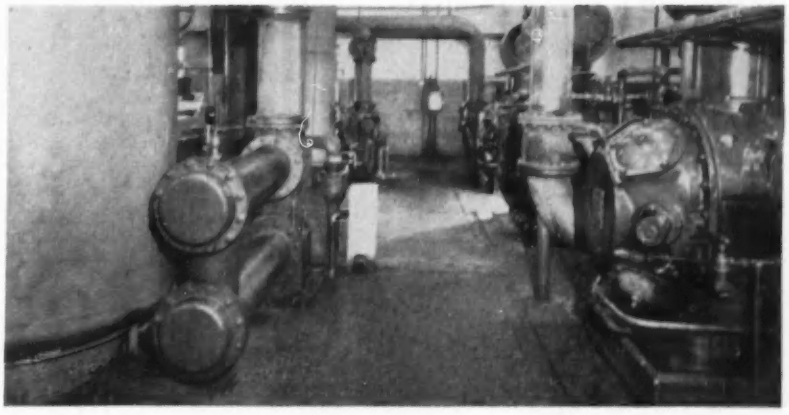
The same advantages are inherent in a large group of pneumatic hoists which are built for special purposes along the assembly lines. Known as "roll-over" hoists, they serve to turn over engine assemblies. The latter start out upside down, and after the crankshaft, bearings and other underside components are in place they are rolled over so that the heads and other top parts can be added.

Generally speaking, the hoists have pull-chain controlled throttle, but newer ones have pendant pilot-valve controls. Most units at Caterpillar are boom mounted—suspended from swinging I beams. Others travel on stationary I-beam tracks or are suspended from a single point. All those equipped with trolleys, no matter who the manufacturer (most of the hoists are I-R units), have standard mountings. In other words, the trolley on any hoist of a given size can be used on any track of that capacity in the plant.

Large quantities of air are also consumed by pneumatic tools of which there are 2000 or more in operation. The majority are of the impact type and, of course, most of them are at work along the assembly lines. Almost all are suspended from overhead counterweighted (or countersprung) hangers. Five of the eight major assembly lines in the factory use only air tools; the remainder are equipped either with high-cycle electric tools (alternating current of 180 or 360 cycles per second) or with a combination of air and electric units. In addition there are some percussive air tools: I-R pin drivers for driving link pins in tracks when they are put on a completed tractor, and riveting hammers equipped with nail sets used in the shipping department for crating engines and for spiking thrust and tie blocks to rail cars when the big tractors are readied for shipment.

Spray painting also consumes a lot of air, as do blowguns, air chucks, collets and clamps widely used in machine-tool operations. Tractor frames are built up from steel plates, special air clamps and jigs holding the pieces in alignment as they are welded. Chipping, sandblasting and grinding are foundry jobs that need much air. Many hoists are busy in the foundry, too. Compressed air is also required for air gauging, drying parts after washing and for control purposes. Boilers, for example, have Hagan air controls. The plant air supply is normally drawn on for use in the boiler room, but to prevent damage resulting from lack of control air a gasoline engine-driven I-R Type 30 compressor is installed there for standby service. Air conditioning is regulated by pneumatic controls, and compressed air is mixed with propane to provide fuel for heavy winter loads. Eighteen 30,000-gallon propane tanks are filled in summer when supplies of natural gas are plentiful. But during the winter months the stored LP gas meets all requirements in excess of the amount specified in Caterpillar's contract with the natural-gas company.

When Benjamin Holt picked the spot for the Peoria plant it was impossible for

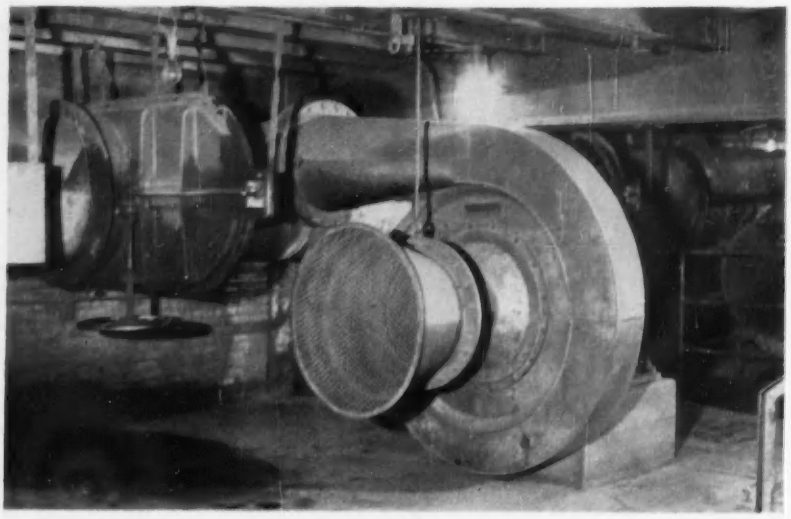


AFTERCOOLERS

All compressors at Caterpillar's Peoria plant are equipped with aftercoolers. In Building KK are two Ingersoll-Rand PRE machines, each of 3330-cfm capacity. Driven by 700-hp synchronous motors, they discharge to the aftercoolers shown at the left in the above picture. In the right foreground is the high-pressure cylinder of one of the compressors and at the end of the corridor formed by the compressors and their aftercoolers and receivers can be seen the Fischer Porter Flometer which measures the station output.

CUPOLA BLOWERS

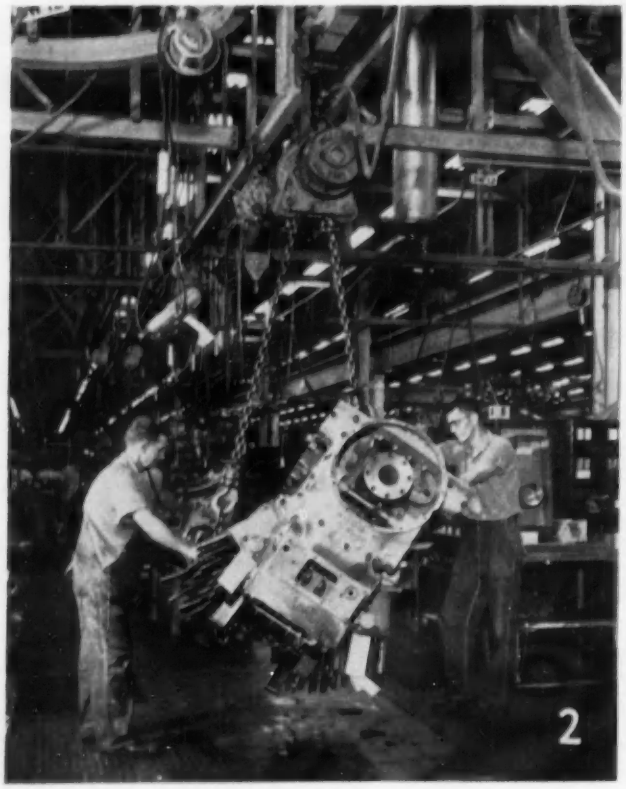
The production cycle at Caterpillar often starts in the foundry, where more than 100,000 tons of castings are poured each year. Its four cupolas operate alternately in pairs. Three Ingersoll-Rand Type FS motorblowers, one of which is shown above, supply air for the melting of metal. The foundry pours up to 600 tons of castings daily. The biggest—transmission cases—weigh about 3200 pounds; the smallest—lever arms for diesel engines—about 8 ounces. Four million molds are used annually in this foundry.

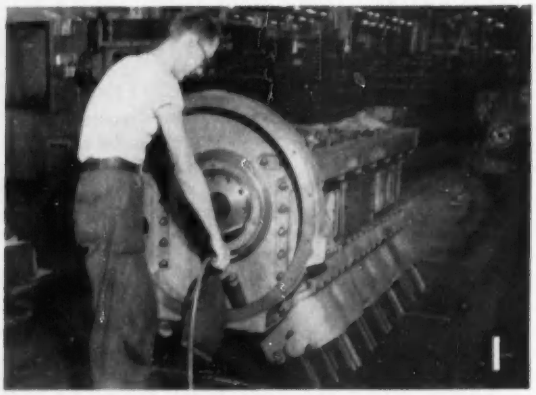


him to visualize its vast growth. He founded his establishment on good ground near the Illinois River. But as the factory expanded, all the dry land was occupied and some of the newer structures had to be built on marshy ground. Naturally, drainage was a big problem. Caterpillar engineers solved it by diverting the oily, greasy, often abrasive and corrosive runoff from factory operations into sumps and using I-R pneumatic sump pumps to remove it. The latter operate automatically—are governed by float controls. Air-powered pumps were chosen simply because they stand up best under the extremely hard service.

A book, titled *50 Years on Tracks*, published by Caterpillar describes plant operations in this way: "Like a huge funnel, the Peoria Plant pours its resources into its assembly lines. Principally for its lines, seven acres of tool cribs dispense everything from hand soap to furnace parts; electrical equipment draws sufficient electricity to provide light and power for a city of 110,000 houses. To the lines are channeled forgings, castings, weldments, the pieces and parts that are bolted, pressed and set in place." To follow the assembly of a Caterpillar track-type tractor through the Peoria Plant in words would be an involved and laborious job: so we'll let pictures tell the story because they can do that much more clearly.

ENGINE ASSEMBLY



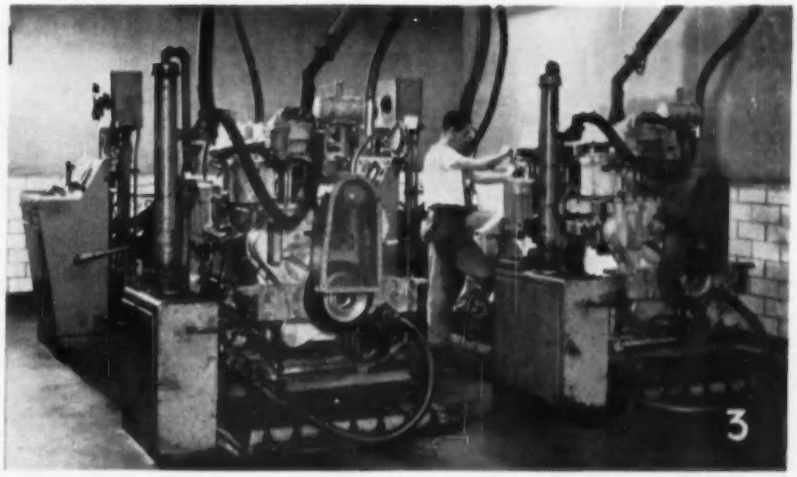


1 Bare blocks are placed on the head end of the moving engine assembly line in Building KK and parts are added at each station it passes. This illustration shows a small air-jet vacuum cleaner being used to remove any dirt or chips remaining in the timing-gear case. The simple efficient cleaner works on the venturi principle and there are no moving parts to be harmed by metal chips.

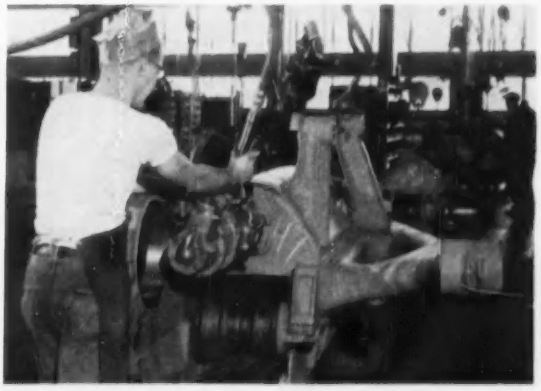
2 When engine blocks start their trip, they are mounted upside down on jigs. This facilitates putting in the crankshaft, pistons, rods and bearings. After all the work on the under parts is completed, the partial assembly is rolled over so that cylinder heads, valves, fuel injectors, the starting engine, etc., may be placed. A specially built Ingersoll-Rand hoist handles the roll-over operation. Of the link-chain type, it takes the chain in at one side and pays it out on the other. In operation each end of the hoist chain is hooked to a special chain sling placed around the engine, one hook being near the cylinder heads or top, the other at the oil pan or bottom; then the hoist takes in the lower hook, paying out chain to the upper one. Thus the engine is rolled over. Hoisting is continued until the engine is upright and is suspended only by the top hook—the one

at the cylinder head. The bottom-hooked chain then is disengaged and the engine lowered to the assembly line again. So fast is the operation that the line itself has scarcely moved in relation to the engine. This illustration shows an engine at the start of the roll-over operation.

3 After an engine has been completed, it goes to one of the many test cells where it and a companion unit are "run in" and completely checked. Quick-connecting couplings on fuel, coolant and exhaust lines facilitate their hook-up. A complete dynamometer check is also run on each engine. Final adjustments are made at this point and when an engine has passed its tests it is ready to be placed in a tractor or to be shipped to another assembly plant or to a customer.



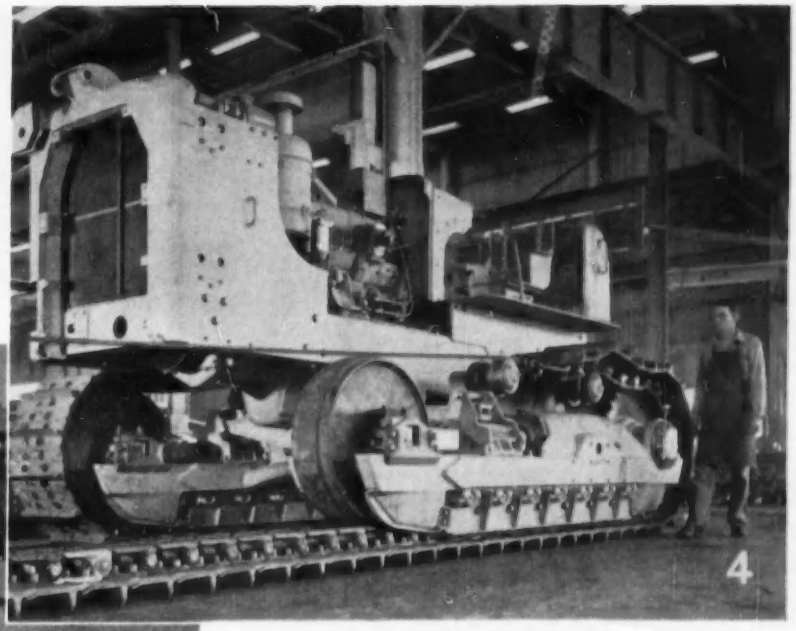
SUBASSEMBLIES

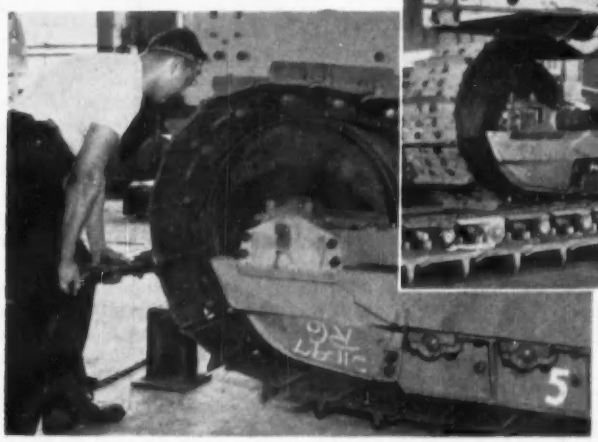


Giant equipment requires giant springs to control and dampen its reactions. The assembly shown above is a track-roller frame and contained in it is a large and powerful coil spring. To get the spring into the frame it is first compressed in a large press. End plates are then placed on the spring and a heavy bolt passed longitudinally through it and its end plates. A nut is drawn up tightly and the spring is released from the press, held in compression by the bolt. Next the spring is placed in the roller frame and aligned. Then the nut on the through bolt must be loosened to give play to the spring. At one time this called for time-consuming and laborious efforts on the part of several men using a large hand socket wrench. Occasionally one of the nuts could not be loosened, and the spring had to be removed, replaced in the press and a new nut and through bolt substituted. Then the Ingersoll-Rand 538 Impactool shown at work in this picture was put on the job. Air power now does the hard work and there are no nuts, no matter how stubborn, that can't be loosened with the Impactool.

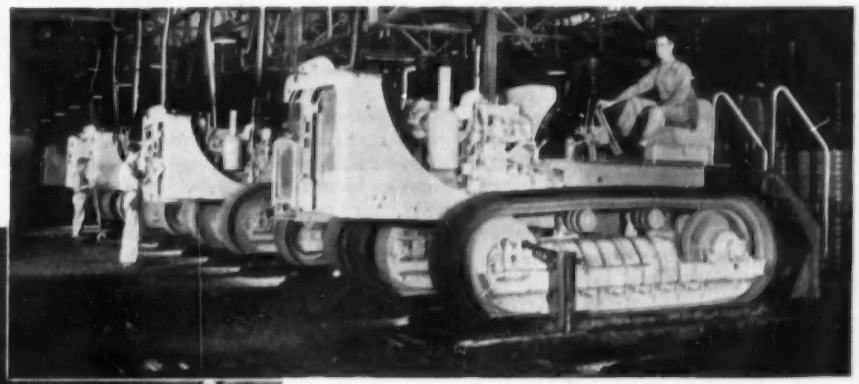
The main assembly line starts out with the making of what might be termed a subassembly—the tractor frame, drawbar brackets and axle shafts. As in the initial steps of the engine assembly line, the work can be done easier with the frame inverted. The suspension crossmember is also added while it is in this upside down position. For subsequent additions, the frame is rolled over and that operation is shown at the left. As the frame moves into position from the right, a chain sling is engaged as shown by passing the hooks under the suspension and then over the longitidinal members. The hoist, an Ingersoll-Rand 5-ton unit, then raises the assembly. The heavier transmission or rear end remains on a roll-over jig and the frame revolves around the axles, the sling passing between the longitudinal members. The frame (this one is for a D8 tractor) is thus brought past the vertical position and lowered rightside up. The sling is then repositioned and the entire assembly lifted across the aisle to the main assembly line at the left (not visible).

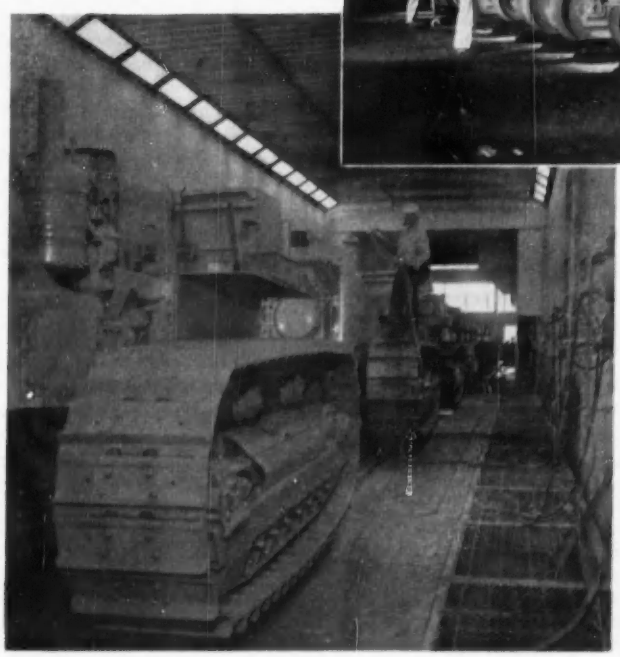
After the tractor's sprockets have engaged the track, a wire rope from a winch is hooked to the trailing end of the track assembly. As the tractor continues forward (No. 4) the winch pulls the tracks around the drive sprocket, over the idlers to the front roller. The final step (No. 5) is to drive the master pin to complete the endless track. Formerly done with a sledge hammer, the operation has been simplified and made safer and less costly by assigning an I-R percussive tool to the job. The tractors shown in these pictures are D9's.





FINISHING TOUCHES





After the tracks are on, the tractor is ready for an operating test. At a location near the assembly floor, machines are backed onto greased skids, secured to a deadhead and the tracks are treadmilled until the inspector is certain the machine meets Caterpillar standards. The steel lugs that bite firmly into rock or earth slip easily, albeit noisily, over the greased skids.

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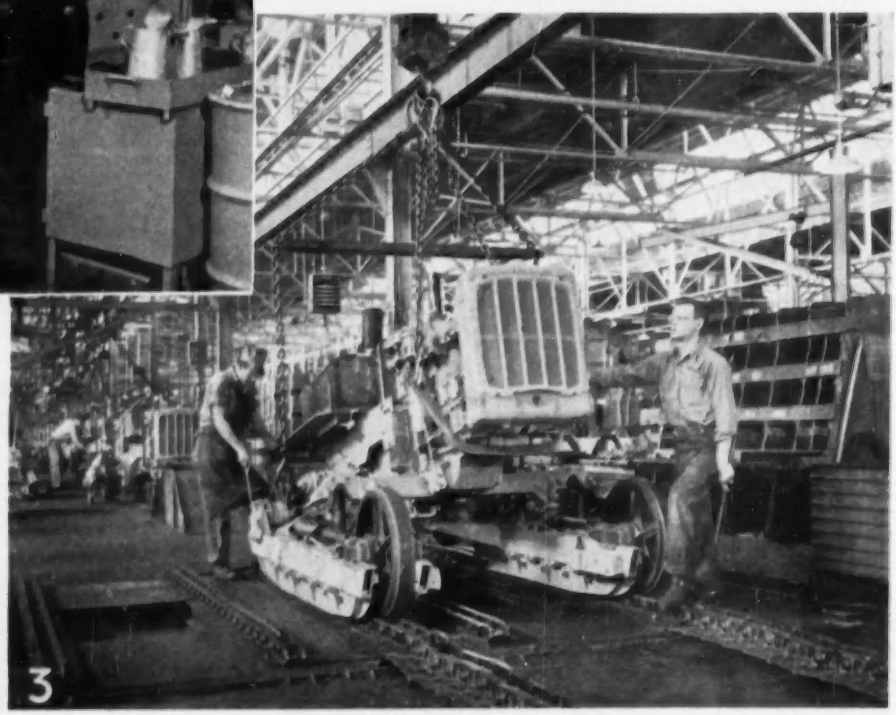
Following testing and approval, machines are driven into paint spray booths where each receives its dress-up coat of Cat Yellow or — even today — olive drab, because the Armed Forces still depend heavily on track-type tractors. It should be emphasized that, while many tractors nominally may be of the same size and type, two identical machines rarely show up side-by-side. Tractors are always built to order and a Caterpillar customer can choose from a hundred-and-one or more options on any model. These minor variations are taken care of at many different points during the production cycle and it is a miracle of American ingenuity and Caterpillar engineers' production planning that the multitudinous parts and subassemblies always wind up at the right spot at the right time.

A TRACTOR TAKES FORM

1 After the frame is rolled over, the sprockets, clutches, brakes, transmission, etc., are added and the growing tractor receives its engine, carried in a special sling attached to the overhead air hoist. The engine is being positioned to bring the holes for the mounting bolts into alignment. The hoist is equipped with a manual chain-operated trolley. The unit shown will become a Traxcavator.

2 With the addition of fuel tanks, operating controls, radiator and part of the sheet-metal work, the embryo tractor has received most of its essential components. In preparation for subsequent steps it is fueled and lubricated. Air-operated grease guns handle the latter job.

3 The next step is the addition of roller frames. These are positioned on track links that have been permanently fastened to the floor. Then the completed engine-frame assembly is picked up and lowered on the roller frame subassembly. The tractor engine is then started and the nearly complete unit rolls forward under its own power onto tracks that have been laid out on the floor in line with the roller frame positioning jig. In this illustration, the tracks may be seen (lower right) in position to receive the D4 tractor.



Editorials

PLAIN BUT IMPORTANT

THE mineral that leads national production in value is not one of the glamor metals such as uranium or aluminum, but plain, unromantic sand and gravel. The former leader it recently displaced was, incidentally, even less glamorous, being soft coal. The tally of production lags behind the calendar but the 1954 figures, as complied by the Bureau of Mines, place the sand and gravel output at 557 million tons—enough, someone has computed, to build 43 Grand Coulee Dams. The National Sand and Gravel Association tries to keep more abreast of the times by querying member companies on their production but gets responses from only about one-third of the 1657 operating concerns on its roster. Its figures are consequently hardly dependable, but they do show a sturdy recent growth of the industry.

Sand and gravel, essentially the same material except for size, play a prominent part in our economy. Not a building rises and not a highway is laid without their aid. They are work horses of the construction field and important elsewhere, as in foundries, for instance. Fortunately, wherever they are needed there is almost always a local source of supply. However, it isn't always practical to use the closest material available. As is true of most things in general use, established concerns turn out the bulk of the sand and gravel consumed and some of them have attained great size. At least one of them, the Warner Company, has pits near Philadelphia so large that it operates its own railway to move material that is dug to the screening plants. Ten of the firms each produce more than 3 million tons annually and three of them exceed 5 million tons.

The two big users of sand and gravel are building and road construction, followed by ready-mixed concrete. The Federal Highway Building Program that is now shaping up will send sand and gravel production skyward. By 1960, it is expected, highway expenditures will reach $8 or $9 billion annually and it is estimated that every $1 billion worth of work will require 75 million tons of sand and gravel.

Nothing seems more plentiful than these materials and yet fears are being expressed that the supply will run short. In recent years the industry has faced objections to working pits within corporate boundaries. They leave unsightly landscape scars and their operation creates dust, noise and heavy truck traffic. Zoning laws accordingly keep them out of many localities, but these restrictions may have to be relaxed if the nation is to get the 40,000 miles of superhighways scheduled for construction during the next 13 years.

Those who dimly remember the 5-cent cigar and the 5-cent cup of coffee and are convinced that there is no longer anything cheap in the world may find solace in the news that sand sells, on the average, for around 95 cents a ton or less than 5 cents per 100 pounds. Gravel is slightly more expensive, averaging $1.14 in 1955.

THE MIRACLE OF CREDIT

A MIDDLE-AGED couple we know, who have always paid cash for whatever they needed, recently bought a rather expensive carpet and asked if they could have a little time to pay for it. They were conducted to the store's credit manager, who asked them routine questions. He wanted to know where the couple maintained charge accounts but they, unfortunately, could not name a single place. The credit man frowned and stroked his chin. It was an awkward situation. The financial lives of the pair, both natives of their community, had been too clean for their own good. In the eyes of the credit manager they didn't have spotless records; they merely had no records. The couple had learned a lesson. Forthwith the wife opened charge accounts at several department stores and thus established credit.

Much of the world's business is done on credit. Individuals can, and many do, pay as they go, but retail and wholesale establishments rarely operate that way. Instead, they render a balance sheet to a central agency or clearing house and are given a credit rating that is published in a directory where all from whom they seek to buy may see it. The largest and best known agency of this sort, familiar by name at least to almost everyone, is Dun & Bradstreet, Inc. This month that concern is sending requests for year-end statements to 2,649,782 business concerns listed in its reference book. The information in these statements will be boiled down by 1800 trained credit reporters into listings that will contain the essential facts desired by manufacturers, wholesalers or jobbers who may be asked to deliver goods of any sort to any of these people against future payment. Between 85 and 90 percent of those listed are classed as little businesses and the listing of the smallest retailer or garage owner occupies the same space as that for United States Steel Corporation or General Motors Corporation. This reference book is revised every 60 days, so the information is always up to date.

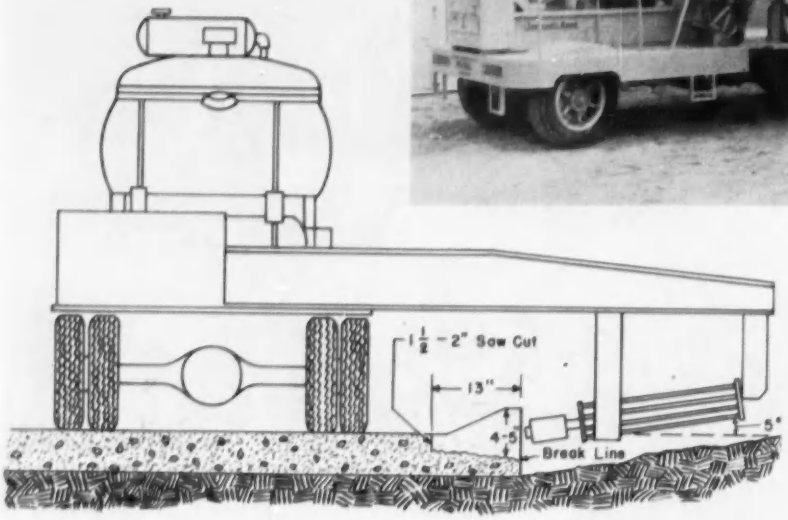
Before mercantile agencies came into existence, two methods of procuring credit information were followed. By one practice the buyer would forward with his order for merchandise letters of reference and recommendation from his local minister, a neighboring lawyer or his fellow merchants. Or, the supplier might write to existing customers or friends located in the potential buyer's community, requesting information and personal opinions regarding the honesty and reputation of the seeker of credit. Both techniques were slow and produced only general information at best. Financial data such as are found in balance sheets and income accounts were seldom included.

Lewis Tappan, a New York silk merchant, conceived the idea of a credit clearing house in 1840 and organized "The Mercantile Agency," which was one root of the present Dun and Bradstreet organization. The national population was then 17 million and there were twenty-six states, only three of them west of the Mississippi River. The first reference book was published in 1858 and contained 18,153 business listings—less than the total for each of thirty-four states today. The current book contains 4000 pages and lists business concerns in 50,000 communities. In addition to the mailed requests mentioned earlier, the publishers have field reporters who average between 25,000 and 50,000 calls a day on business houses located in hamlets, towns and cities in every section of the country.

Six issues of the register annually are necessary to keep up with the changing roster of the business world. Every year between 350,000 and 400,000 firms cease functioning and about as many new ones are formed. In addition, approximately 400,000 establishments acquire new owners. During the first six months of 1955 an average of 5619 changes in listings were made for each business day.

Aided by modern methods of fast communication, that disseminate credit information almost immediately, credit does much to speed the smooth interchange of goods. It is hard to conceive of doing business on our present scale without it. More than 100 years ago a great American, Daniel Webster, made a memorable speech in the United States Senate on the importance of credit and some of his words are as true now as they were then.

"Credit," he said, "is the vital air of the system of modern commerce. It has done more, a thousand times more, to enrich nations than all the mines of all the world. It has excited labor, stimulated manufactures, pushed commerce over every sea, and brought every nation, every kingdom, and every small tribe among the races of men to be known to all the rest. It has raised armies, equipped navies, and, triumphed over the gross power of mere numbers."



Pneumatic Muscles Widen Iowa's Roads

THE odd-looking monsters Iowans are seeing at work along some of their highways are not giant nutcrackers—they're curb-breaking machines. The curbing is being removed in the process of widening 700 miles of the state's 18-foot roads and converting them into modern 24-foot highways. The demolition unit travels along in the wake of a concrete saw and smashes the hazardous lip curbs along the edge of the roadways.

The curb breaker itself is manufactured by the J.D. Armstrong Company, of Ames, Iowa, and is the outgrowth of an experimental machine that was mounted on a truck with an air compressor in tow. That equipment was difficult to keep in proper alignment, so improvements had to be made.

The present model is a self-powered, wheel-mounted unit that moves along the roadway hammering away at the pre-sawed curb as it goes. It is entirely air operated—the compressor mounted on the front end of the truck supplying air to drive the breaker or ram and the motor which propels the machine. Two men are required to run it, one to steer it while the other manipulates the valves and levers which control the ram and motor.

When the rig is working, a cantilever arm or outrigger extends over the shoulder of the road. Iowa highway regulations limit the width of vehicles to 8 feet, so when the unit goes from job to job the arm is folded back against its side. Suspended from the outrigger is the ram, which consists of a heavy head attached to a cylinder piston. Inserted in the head is a specially designed renewable chisel bit that strikes the concrete slab about 4 or 5 inches below the top of the curb.

Working ahead of the breaker, the diamond- or carbide-tipped concrete saw makes a 1½- or 2-inch cut 13 inches in from the edge of the slab. Next, a road grader removes the dirt from the adjacent shoulder, thus enabling the machine to get into battering position. The ram strikes at a downward angle of 5 degrees, transmitting the concussion upward to the saw cut. This results in a clean break, leaving a shelf of old concrete.

On a typical job the curb breaker is said to demolish up to 8000 linear feet of curb in a 12-hour day. Iowa plans to use six of these machines to remove the 600 miles of curbing along the highways that are to be widened

Graphite Welded for The First Time

FOR the first time, it is reported, graphite has been melted and welded together. This pronouncement was made at the dedication of the multimillion dollar Research Laboratories built by Union Carbide & Carbon Corporation at Parma, Ohio. The mineral, which is a crystalline form of carbon, vaporizes directly into a gas when heated at high temperature under normal pressure; but when it is heated under high pressure, vaporization is prevented and the mineral melts.

The discovery, made by scientists of the National Carbon Company, a division of Union Carbide, has led to the production of new forms of graphite and to a method of welding them. The pieces to be joined are placed in an atmosphere of inert argon under high pressure and brought in contact with one another. Then direct current is passed through them, and after that they are separated slightly, thus creating an arc that heats the graphite to an extremely high temperature. This, together with the pressure, melts the mineral and welds it. It is also possible to produce comparatively large pieces from the liquid state by a sort of continuous casting process. Material so made is said to have a degree of crystalline perfection comparable with that of the best natural graphite.

In pointing out the significance of welded graphite, Dr. Robert G. Breckenridge, director of the laboratories, stated: "It suggests the possibility of prefabricating sheets and panels for the assembly of nuclear reactor moderators which now must be built up from graphite blocks. Graphite is an essential material in nuclear reactors because of its neutron-slowing abilities which make possible the self-sustaining chain reaction necessary in harnessing nuclear energy."

This and That

Air Aids Propagation Of Trout

Fishermen who are followers of Red Smith's popular copyrighted syndicated sports column that appears nationally in newspapers no doubt blinked an eye or two when they read his December 10 dispatch from Melbourne, where he had been covering the Olympic games. The column described a trout fishing trip to the Maieson River, near the mining camp of Jamieson, a short distance from Melbourne.

It was a poor day for the anglers, who caught nothing big enough to keep because over (or down) there, it seems, they throw back everything under 5 pounds. A barmaid in a "pub" where the party stopped displayed a picture of a 13½-pounder she had snared two weeks before but she wasn't bragging about it because a small boy had since landed one 2 pounds heavier.

On the way back to the city, the group paused at a hatchery that annually produces 600,000 yearling fish for stocking the streams thereabouts. To quote Smith, "Jim Wharton works in the laboratory to increase the yield. Jim has struck on a method of stripping spawn from the fish which seems to result in a fertility rate close to 100 percent. Instead of removing the roe by massaging the fish's belly by hand, he inserts a hypodermic needle and forces the eggs out with compressed air."

* * *

Scarcity of Metals Explained

According to scientists, it's no wonder that gold, uranium and other valuable metals are hard to find. Recent studies aimed at determining the amount of each element in the universe have turned up the fact, disconcerting to prospectors at least, that all those heavier than helium in the atomic table account for only a little more than 1 percent by weight of all matter in the universe. By far the most abundant element is hydrogen, which accounts for almost 93 percent of the total number of atoms and 76 percent of the total weight of the universe. Next in line is helium which makes up about 7 percent of the atoms and 23 percent of the total weight. The heaviest elements (gold, silver, uranium, etc.), say the scientists, add up to only one one-hundred millionth of all matter by number of atoms and one millionth by weight. In general, the researchers have discovered that the abundance of the elements drops off with increasing atomic weight, following a curve that has only one major anomaly—the elements of the iron group. The latter are about 10,000 times more plentiful than their neighbors in the atomic table. The scientists speculate that all elements originally were formed from electrons and hydrogen protons by a highly complex series of nuclear reactions taking place in stars.

* * *

Newsprint from Dead Timber

A paper mill now going up in Colorado will manufacture newsprint from trees that are dead, most of them having been killed by beetles. The timber will be obtained from the White River and Routt national forests. J. & J. Rogers Company, which is building the $5,000,000 mill, outbid two other concerns to buy 3,000,000 cords of wood. The contract, amounting to $10 million, is the largest for a timber sale ever executed by the U. S. Forest Service in the Continental United States. The mill will be Colorado's first source of newsprint, which is now shipped in from the West Coast and Canada.

* * *

Size of "H" Power Reactor

Hsue-Shen Tsien, professor of jet propulsion at the California Institute of Technology, estimates that the smallest thermonuclear reactor (one based on the nuclean reactions occurring in an H-bomb explosion) feasible at this time would fill a tank 3300 feet long and 330 feet in diameter and would produce enough heat to quintuple the United States output of electricity. The reaction in the heart of the device would generate a temperature of 10 million degrees centigrade. Professor Hsue-Shen made his estimate in a recent article in *Jet Propulsion*, journal of the American Rocket Society and pointed out that a reactor of that size would be 30 times larger than the *Queen Mary*.

* * *

Calculus Of Lifting Capacity

Scientists generally agree that the bigger you are, the more weight you should be able to lift. This rule of thumb has now been expressed as a mathematical ratio by M. H. Lietzke, a chemist at Oak Ridge National Laboratory who has a penchant for reducing athletic prowess to arithmetic formulas. He calculates that weight-lifting ability should be proportional to the ⅔ power of body weight and by plotting world records for each weight class, his idea is strikingly confirmed. He also has reduced champions in all classes to a common denominator by measuring the deviation of the results of their efforts from the curve of his formula. The greater the distance above the line, the more exceptional is the performance of the individual, no matter whether he is in the light- or heavyweight class. Lietzke extended his graph only to the 198-pound bracket — the next class is unlimited in body weight and he believes that the individuals in that class would not train down to pure bone and muscle—the only portion of body weight that really counts.

* * *

New Twist on "Cold Working"

The aircraft industry has gone all out for honeycombed materials—sandwiched layers of a cellular plastic, paper or metal filler and thin metal facings—because of their high strength-to-weight ratios. One honeycomb product, for example, would be five-times heavier if made with plywood, ten-times if with aluminum and sixteen-times if steel were used. One of the most difficult problems relating to the use of honeycombs has been the question of how to contour a surface. The honeycomb, when unsupported by its foil facings, is extremely susceptible to bending and other damage and is practically impossible to mill or machine. Today, however, the industry immerses the honeycomb in water, freezes the whole mass and then machines it. The thin cell walls are rigidly supported by the ice, and when the piece is shaped, it's merely set aside to thaw out before progressing to the next step.

* * *

Motoring Without Gasoline

The shortage of gasoline in Europe resulting from the closing of the Suez Canal has revived talk of the necessity of running motor vehicles with substitute fuels, as was widely done during World War II. Looking forward to such a need, the Volvo Company, Sweden's largest manufacturer of automobiles, has been conducting research for several years and is consequently in a position where it could within a few months begin turning out large numbers of cars equipped for operation with producer gas. The company, with its subsidiaries, is also prepared to make farm tractors that can utilize the same fuel.

Producer gas is generated from solid fuel such as wood, charcoal or coal. In 1942 probably 500,000 passenger cars, buses and trucks in Europe carried generators to manufacture this "gasogene." Thousands of other vehicles ran on illuminating gas. The Germans had made prewar preparations for this in order to

save gasoline for military purposes. They had filling stations where the gas was compressed to as much as 5000 psi pressure and stored in cylinders from which it was fed to smaller cylinders on the cars that took the place of gasoline tanks. In some other countries, notably England, the gas was carried, at low pressure, in fabric bags stowed on the tops of buses and trucks. The supply was replenished, as needed, from city gas mains. In most of Europe, wartime farm tractors were designed to burn kerosene or paraffin, both of which were more plentiful than gasoline.

* * *

Automatic Boiler Testing

When a steam power plant is completed and ready to go to work it still must be regulated to produce steam, and thus electricity, most efficiently. Many variables must be precisely controlled to do this—among them are steam pressures, temperatures, air, steam and gas flows, gas composition, fuel rates, etc. The old way of running boiler setup tests was to collect the information and then painstakingly analyze it, all by manual methods. This time-consuming job may be on the way out, thanks to a new automatic boiler test system being examined jointly by Babcock & Wilcox Company and Bailey Meter Company. Analog sensing devices hooked up at various points in the steam system collect the needed data and transfer them to punched tapes. The information thereon is teletyped to B & W's New York City offices and there fed to a computor along with necessary design information. The electronic "brain" can quickly solve thousands of complex equations and come up with the answers needed to instruct operating engineers how to get the best performance from the new plant, saving many man-hours of work and getting into operation that much sooner. So far the system has been tried out successfully at West Penn Power Company's Springdale, Pa., plant. One hundred forty sensing devices were required for that analysis. Another test is scheduled for a huge, super-critical-pressure boiler being installed for American Gas & Electric Company at Philo, Ohio. Correctly regulating this installation will require obtaining data from 500 different points in the steam system.

* * *

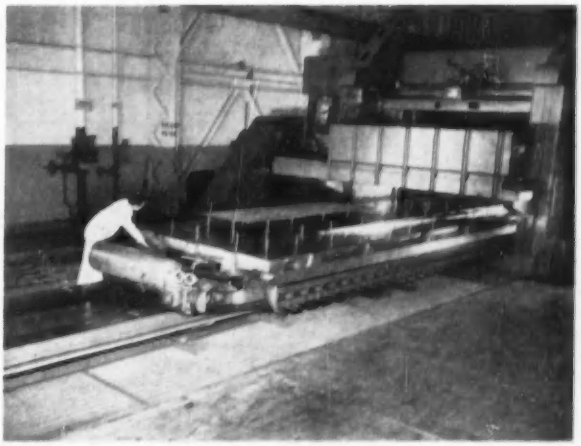
Radiation Fixes Nitrogen

Nitrogen dioxide, a raw material for nitric acid and nitrate fertilizers, can now be made by irradiating air in a nuclear reactor, according to P. Harteck and S. Dondes of Rensselaer Polytechnic Institute, Troy, N. Y. The process and the effects of radiation on nitrogen and oxygen are described in *Nucleonics*. Radiation converts nitrogen and oxygen in air into a complex mixture of atoms and ionized molecules, of which one is fixed nitrogen. The scientists have discovered that adding small quantities of oxide of uranium 235 to the air to be treated results in increased productivity. Trial results at Brookhaven National Laboratories have indicated that from every pound of U-235 consumed in the processing reactor, more than 500 tons of nitrogen dioxide can be produced. Thus, a reactor capable of manufacturing $4 to $6 million worth of electric power in a year could, as a by-product, not only produce 200-degree heat equal to that obtainable from 500,000 tons of coal and large amounts of nitrous oxide, but could also turn out about $10 million worth of nitrogen dioxide within the same period of time.

* * *

Tooth Drill Shown

An air-operated dental drill that was mentioned in our September issue (page 278) as having been developed in Europe was demonstrated in Paris on December 1 to 1000 dentists from all over the world. The tool is driven by an air turbine that is said to reach a speed of 140,000 rpm. Gearing reduces the speed of the burr shaft to 50,000 rpm, which is reported to be four or five times that of conventional drills. It is claimed that a pressure only one-thirtieth of that normally applied will produce efficient drilling and that this "feather-light" touch causes the patient only minor discomfort because little frictional heat is developed. Most of the discharged air leaves the tool via the handle, but a small volume, after cooling the bearings, follows the burr shaft into the patient's mouth and there removes the tooth cuttings and holds back saliva. A Swedish dentist, Ivar Norlen, invented the drill.



COMPRESSED AIR MAKES LIFTING EASY

The transfer plate and die shown here have a combined weight of 1000 pounds and were formerly moved under the hydropress by five men. Now the assembly is floated into position with ease on a thin cushion of compressed air, which is introduced at 100-psi pressure through six evenly spaced ⅛-inch orifices and brought to bear against the underside of the plate. When the die has been spotted under the press the air is turned off and the transfer plate immobilized. The application was developed by Northrop Aircraft, Inc., tooling engineers.

Pictured above is a big Giddings & Lewis skin and spar mill installed in the El Segundo, Calif., plant of Douglas Aircraft Company, Inc. It machines blanks, sheet or plate stock up to 10x40 feet in size. During milling the stock is held in place by vacuum chucks spotted throughout the table; after the work is finished it is raised from the bed of the machine by numerous fingerlike pneumatic lifters, as shown, to facilitate handling. The big table of the 250-ton mill is made up of two 20-foot sections for sensitivity of control.

Industrial Notes

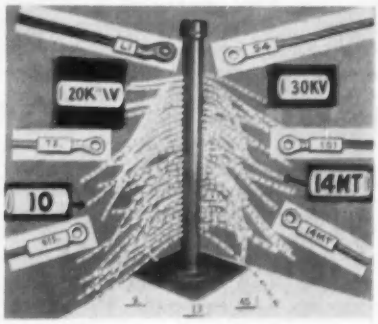
By introducing the Hydra-Boom Shaft Jumbo, Ingersoll-Rand Company has made a notable advance in shaft-drilling equipment. If given four factors — maximum weight limitations, shaft dimensions, size of headframe opening and minimum compartment limitations — I-R engineers can design one of these multiple-drill units to meet any set of drilling conditions. With such a rig, setting up time is reduced, drilling time is shortened and fewer men are required because only one hose connection is needed, controls are conveniently placed and quick-, positive-acting mechanical rib jacks are used. The manufacturer claims that the equipment in operation gives better control of hole pattern and direction, better rock fragmentation and allows the use of large machines for fast drilling of complete rounds at one set-up. Because a metal canopy is part of the basic machinery and the floor area is uncluttered, safety is an integral feature. Descriptive literature (Bulletin No. 4188) is available.

Circle 1E on reply card

Anderson, Greenwood & Company is marketing a stainless steel metering plug valve equipped with a nylon seat. Straight-through high-volume passage and a non-lubricated rising-stem design eliminate flow patterns that otherwise, when directed against a stem-seat and threads, cause erosion. According to the manufacturer, this fixture has a trouble-free bubble-tight reseating action.

Circle 2E on reply card

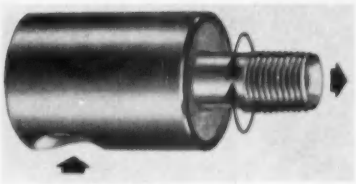
Thermoplastic wire may be coded by letters and/or numbers with greater speed and permanency as a result of the development of a wire-marking system by the Electric Control Products Company. A tree-like dispensing rack that rotates on a flat base has 106 protrusions at right angles to a central cylinder. Each finger has its own code markings. By placing the unit on or near a bench,



selection of the tube that bears the code assigned to the circuit being wired is easy. By merely snipping off a portion of the tubing and slipping it on the wire, permanent, clear and oil-, acid- and heat-resistant identification is possible according to the manufacturer's report. The markers are available in most colors and in standard and special-order diameters and lengths.

Circle 3E on reply card

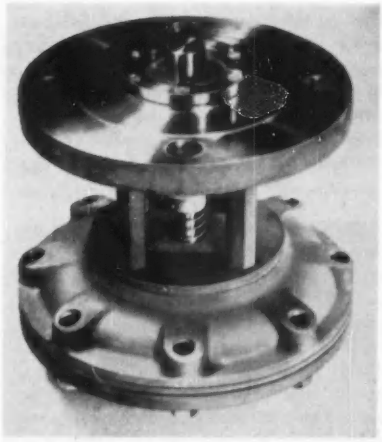
A line of lightweight, low-cost, single-plane, swivel-type joints has been introduced by Barco Manufacturing Company. Designed for 360-degree rotation with low torque at all pressures, they reduce required hose length by eliminating sharp bends and at the same time increase durability by relieving all twist



stresses. The joints, produced in ball- and thrust-bearing types, are suitable for hydraulic or pneumatic pressures as high as 2000 psi, according to the manufacturer. Recommended temperature ratings range from –20° to 225°F. Bearings are equipped with O-ring seals that require no lubrication maintenance in normal service.

Circle 4E on reply card

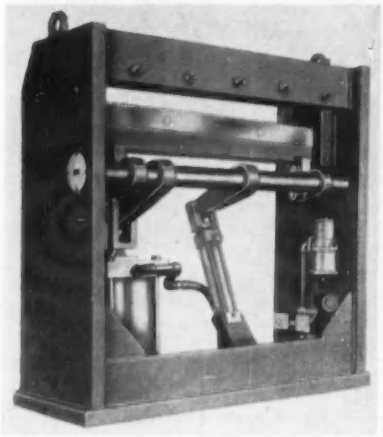
Conoflow Corporation offers Model "P" pressure transmitters for pneumatic liquid-level control. Operating on a force balance principle, the relays are suitable for service with viscous materials or fluids with solids in suspension which might solidify in or otherwise clog the



static lines of bourdon tubes. Because simple, flat diaphragms constructed of rubber, teflon or stainless steel are used in lieu of bellows, it is claimed that there are no convolutions or other areas where fluid may be trapped and coagulate. A supersensitive pilot is isolated from the pressure diaphragm to prevent gas or liquid from backing up into air lines in case of the latter's failure.

Circle 5E on reply card

Air-operated shears for cutting ferrous or nonferrous metal strip are now made by Curry Shear Corporation. Previous types were suitable for cutting only rounds and other bar stock. The new models are recommended for use on hot



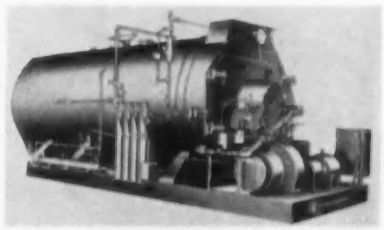
or cold carbon or stainless steel, copper and aluminum. They will cut mild steel strip up to 5/16-inch thick and from 24 to 84 inches wide. The unit illustrated is an up-cut type with 40-inch blades suitable for cutting mild steel or stainless strip. Controls may be operated by hand, foot or air.

Circle 6E on reply card

Devcon Corporation has developed an 80-percent-steel, 20-percent-plastic adhesive for metals and other materials that is now being used for rebuilding broken machinery, filling large and small holes in castings, building up worn metal surfaces, repairing stripped threads and for many similar applications. The mixture is called Devcon—The Plastic Steel and two varieties are available: one, a putty-type, can be applied to vertical surfaces without running or sagging; and the other, a viscous liquid, can be poured. It is claimed that neither heat nor pressure is required to set it, that there is practically no shrinkage during hardening and that it can be machined as ordinary steel in 2 hours after application. This exceptionally durable and permanent substance has a compression strength of approximately 18,000 psi and is highly resistant to most acids, alkalies and chemicals.

Circle 7E on reply card

A 750-hp package steam generator capable of delivering 26,000 pounds of steam per hour at more than 80-percent efficiency has been designed by Cyclotherm Division, National-U. S. Radiator Corporation. The unit is no larger than most 500-hp types—has over-all dimensions of 28x9½x10⅔ feet—and can be adapted to burn either LP-gas or light oil. It is claimed that this machine combines many advantages formerly associated exclusively with boilers requiring large smokestacks, separate buildings



and assembly at plant sites with all the features of package steam generators.

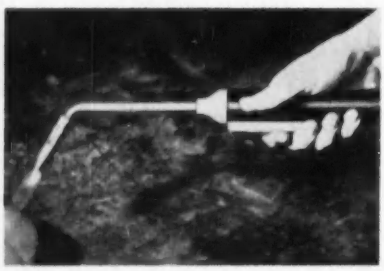
Circle 8E on reply card

A simple hand computer for rapidly calculating the water content of gases has been developed by A.W. Diniak and E. R. Weaver of the National Bureau of Standards. The device consists of two small rotating disks attached to a 4-inch circular plastic base plate, each marked with appropriate temperature, pressure and altitude scales. Additional graduations may be read through a plastic window in the top section and a slide-rule-type scale on the rim of the base may be used for a number of computations involving conversion from one unit to another. The calculator is designed primarily to check water content and dewpoint of gases from observations of the electrical conduction of a hygroscopic film as it absorbs water vapor. Corrections are automatically made for devia-

tions from the ideal laws relating to vapors in gases. According to a report received from the U. S. Department of Commerce, this computer will save considerable time in such industrial applications as the determination of refrigerating system characteristics and control of moisture in inert and reducing gases. It has been used by the armed services to calculate the water content of aviators' oxygen, rocket fuels and fire-extinguisher gases.

Circle 9E on reply card

The acetylene torch shown lights automatically (by a battery-powered spark) when the operator presses the control lever in the handle and shuts off instantly when he releases his grip on it. Two dry-cell batteries that are good for



hundreds of ignitions fit into the plastic handle. Called Torch-O-Matic, the torch provides a flame of approximately 3000° F. Interchangeable nozzles or tips make it adaptable to various types of jobs. It is manufactured by Velocity Power Tool Company.

Circle 10E on reply card

Although Parsborn Corporation's Ventrijet controls dust by the wet-collection method, it does not depend on spray nozzles and requires no water pump. Instead it utilizes the principle of the venturi tube, mixing dust-laden air with water particles and directing this mixture against impingement plates which trap the water and dust from the air. The self-contained unit features low head room and minimum flow space. Uniform air flow, according to the manufacturer, results in increased efficiency. Venturi tubes can be easily and inexpensively replaced in cases where abrasive or corrosive dusts have affected them. It is reported that this collector is particularly effective in the control of linity, greasy-buffing-wheel and similar dusts of average fineness.

Circle 11E on reply card

Vac-U-Max is an air-operated high-suction industrial cleaner with hopper capacities of 30 or 55 gallons. When connected to shop air lines, this device, according to Vac-U-Max Sales Company, creates a vacuum of about half atmospheric pressure, or twice the suction of normal electrically operated units. Because the unit uses compressed air there is no danger of explosion when operating in hazardous atmospheres. Little maintenance is required because there are no moving parts, bearings, motors, or electrical connectors. Based on the jet-venturi principle, this unit operates efficiently on an air pressure of 30 psi or

more and has sufficient power to lift water 18 feet or to pick up any solid object that will pass through the hose. Four standard models are available and special designs may be ordered.

Circle 12E on reply card

International Register Company is manufacturing an automatic timer capable of providing a wide variety of repetitive timings. Known as the Intermatic Cycler-12, the device has a 10-second to 11-minute-10-second interval range for on-operations and a 50-second to 11-minute-50-second range for off-cycles. The unit can be manually controlled without interrupting the automatic cycle and features a snap-out mechanism and easy-to-change trippers. Presently they are available only for 125-volt operation with a capacity of 1875 watts. *Circle 13E on reply card*

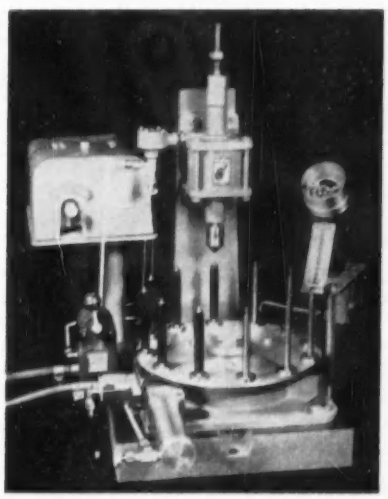
The Sheffield Corporation has announced a new Precisionaire gauge that measures thickness and parallelism of half-moon type retaining rings at three points. The unit consists of a 3-column Precisionaire instrument and a feeding

and gauging fixture. Mounted on the bench-type base of the latter are a vertical stacking tube that holds the rings to be inspected and a push-pull feed mechanism that slides them individually under three Plunjet gauging cartridges. Each Plunjet is connected to its own air column in the Precisionaire. When a ring

comes in contact with the three cartridges the operator glances at the position of the floats in the Precisionaire to determine tolerance, size classification and parallelism. According to Sheffield, the gauge will permit classification in 0.0001-inch increments for the selective assembly of 400-500 parts per hour.

Circle 14E on reply card

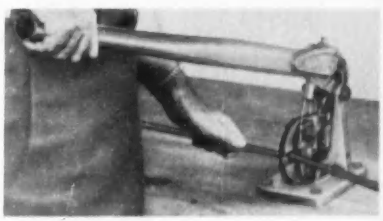
An air-operated rotary work feeder combines with a pneumatic timer, an air press and a miniature hopper to crimp eyelets and rings on barrels of fountain pens. Each fixture is mounted on a standard Mead Universal base to form a semi-automatic machine. At the work



stations, a single-acting air cylinder with a crimping tool attached to a ram, presses the components together. A Meadmatic Timer, a self-contained unit mounted on a post, controls the number of cycles per minute and the length of the dwell. A speed control valve regulates the down stroke of the tool and a quick exhaust valve clears the work before the table indexes. A midget cylinder, also deriving its air from the timer, rotates the hopper. The pen barrels are held on twelve special studs around the rim of the dial, where they are placed by hand over the eyelet which has dropped on the stud from the hopper. According to the manufacturer, Mead Specialities Company, production was increased, quality improved and spoilage reduced. These same standard units can be applied to other similar operations.

Circle 15E on reply card

For cutting soft or medium-hard metal rods, bolts, cables, etc., up to ½ inch in diameter, a new heavy-duty cutter is efficient and labor saving. Ruggedly built in two sizes, with a variety of jaws for specific materials, according to H. K.



Porter, Inc., the manufacturer, it can be fastened securely to bench or work stations or mounted on a plank and moved from job to job. The design of the unit is such that only one hand is necessary to power it, thus leaving the other free for feeding stock.

Circle 16E on reply card

Fuel-Aid is the name of a new additive that is designed to increase the operating efficiency of diesel engines. Introduced by Harflo Products, it is a combination of compounds that is said to be completely combustible with diesel fuel, harmless to the system, nonexplosive and nonpoisonous and to prevent the formation of sludge. The fluid is poured directly into the fuel tank or mixed with the diesel fuel at the rate of 2 quarts for the first 50 gallons and 1 quart per 125 gallons thereafter.

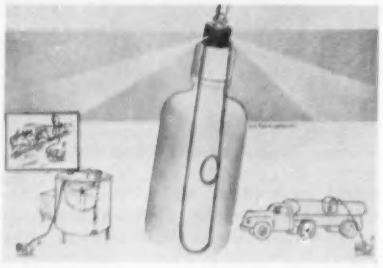
Circle 17E on reply card

American Automation, Inc., has developed a multi-color silk screen press that operates on a conveyor principle and features a self-contained drying unit and standard two-way adjustable squeegees that can be set to flood and print. Thus printing of one or more colors at a single operation is possible. Accuracy is maintained by use of air cylinders, motors and automatic relays while an automatic stop mechanism insures hairline registration. The machines are adaptable for use on paper, textiles or other hard-surface objects with thicknesses ranging from tissue-thin to 6 inches. Standard models with a print-

ing surface area of 13x18 inches are in production and larger ones are available on special order. According to the company, two men and a standard 4-color unit can produce twenty 1-color, twelve 2-color or six 3- or 4-color jobs in one minute.

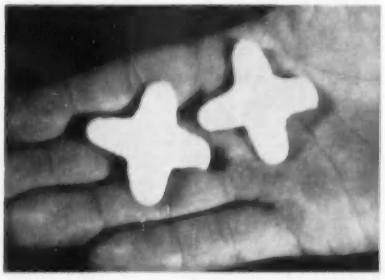
Circle 18E on reply card

Super Manufacturing Corporation has announced the development of an air sanitizer that releases a penetrating spray into every corner and crevice of an area to be protected from contamination, thus eliminating any necessity to sponge, mop, swab or wash. The appara-



tus, called Super Air Sanitizer, consists of a 1-quart polyethylene bottle equipped with a 4-way spray head and attached to an air compressor by a rubber hose. Operation is simple: the container, filled with liquid disinfectant or insecticide, is hung inside the vessel or room to be treated and the compressor is started. It is claimed that only 1 to 5 minutes are required for the average job. These units are especially engineered for use with chlorine solutions, disinfectants, insecticides or any corrosive solutions.

Circle 19E on reply card



EVAPORATION RETARDERS

These are Mini-Vaps, expanded polyethylene miniature floats containing thousands of air cells that make them light and buoyant. Their shape facilitates interlocking into a protective covering over liquids that reduces evaporation by as much as 75 percent. Made by American Agile Corporation, Cleveland, Ohio, Mini-Vaps are approximately 1½ inches wide and ¼ inch thick. They resist most chemicals and solvents and cannot be punctured or broken in ordinary service. Suggested applications include plating, fermenting, cleaning, dyeing, rinsing, aging and pickling tanks; solvent and oil storage, dairy processing vessels, etc.

Circle 20E on reply card

BRIEFS

A new British suit for protecting workers in contaminated atmospheres not only supplies compressed air for breathing, but also for cooling the wearer's body. It is a 2-ply garment. The inner layer is made of net fabric that incorporates a capillary system of small tubing with 48 outlets on the legs, arms and body. The outer layer is a white fabric that resists damage from tearing and abrasion. It is sealed at a front opening, around the wrists and below the knees to exclude toxic vapors or dust and the air liberated inside it is exhausted through non-return valves located below the elbows and above the knees. The air is admitted at the back at around 6-psi pressure through a hose connection above the waist. The hose derives its supply from plant air lines or a portable compressor.

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Oak Ridge National Laboratory, operated for the Atomic Energy Commission by Union Carbide Nuclear Company, a Division of Union Carbide and Carbon Corporation, has completed its first 10 years of producing radioisotopes. More than 85,000 units have been delivered to some 2700 users in the United States and 57 foreign countries. Today, nearly 100 different types are available for radiography and radiation damage studies as well as for "tagging" chemical compounds, mechanical-wear tests and radiation chemistry research. It is estimated that they save industry more than $200 million annually.

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According to S.W. Platt, of Platt Metals, Limited, Enfield, England, "scrap metal melted down and reformed into ingots is often better than virgin metal that has never been used before. Experience shows that metal 'matures' with each melting. Rather like wine, the older it is the better it becomes."

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The National Union of Mineworkers reports that the average British miner is now more than 40 years of age, whereas in 1936 he was 36. Thousands of them are between 50 and 60 and many exceed 65.

Industrial Books and Literature

Instrument Technology, Volume II, by E. B. Jones can now be obtained from Butterworths Scientific Publications, 88 Kingsway, London, W.C. 2, England. Second in a series of three works on instruments and instrumentation this volume deals with sampling and analyzing mechanisms. Volume I treats instruments that measure flow, pressure, level and temperature and Volume III, when released, will cover telemetering and control devices. Because the mathematics has been kept as simple as possible and basic physics concepts covering each class of instrument have clearly been stated, the publisher reports that the books are useful for apprentice training as well as a complete reference on the general subject. Volume II has 208 pages, is well illustrated with sketches and schematic drawings and, in detail, treats sampling systems, measurement of density or specific gravity, humidity, and viscosity and quantitative and qualitative chemical analysis including spectrochemical methods. Price, 40 shillings (about $5.60); via post 41s. 6d. (about $5.85).

An indexed directory of names, titles and addresses of key executives in more than 2000 national trade associations and related organizations has been compiled by Jan Judkins, Chief of Trade Association Divisions, U. S. Department of Commerce. Nine hundred fifty organizations of manufacturers, most numerous of which are those in the metal products field, and 350 of distributers are listed. Among larger classifications are 250 national associations in the construction and building materials field and 230 each in the food and textile industries. A copy of the *Directory of National Trade Associations* may be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, 40 cents.

Self-locking Unbrako socket screws are the subject of a 16-page booklet issued by Standard Pressed Steel Company. The catalogue describes and illustrates the Nylok principle of a self-locking insert and gives examples suggesting a variety of applications in which vibration-proof screws can be used to eliminate any need for lock washers, wired heads or other extras. Specifications for the locking pellet include technical data on material, temperature range of application, resistance to fluids, durability and "plastic memory", i.e., the tendency to return to its original shape after having been deformed. *Circle 21E on reply card*

A 2-page bulletin (No. 302) illustrating three models of Dehydrafilters has been released by Hankison Corporation. The fixtures are designed to remove moisture and oil vapors from compressed air supplied to instruments and controls on dead-end or low-flow service. Costly tracing of air lines can be eliminated, it is claimed, because dew points of -67°F are obtainable. Description of operations and uses of these small-volume desiccant devices is also included.

Circle 22E on reply card

Four different methods of vertically filing blueprints, maps, etc., are described in *The Plan Hold Story*, an 8-page catalogue (No. 5) issued by Plan Hold of California, a division of Air Comfort Company.

Circle 23E on reply card

A catalogue (No. G-560) that simplifies the problem of selecting metal hose and tub-

ing for industrial equipment and maintenance applications has been released by the American Metal Hose Division of The American Brass Company. The 64-page publication of helpful design suggestions includes metal hose and tubing specifications, bend diameters, lengths, types, construction diagrams and descriptions of end fittings.

Circle 24E on reply card

Extensive data on refrigerator, high-reactance and encapsulated transformers for oil-well, mine, pumphouse and similar locations are listed in a special section of Bulletin GED-2767A published by General Electric Company. Detailed information on voltage ratings, frequency, frame size, weight, application and price specifications for autotransformers, control-panel and machine-tool transformers is also included.

Circle 25E on reply card

Lubricated plug valves are treated in a 28-page catalogue (Reference Book 39, Section 5) published by Homestead Valve Manufacturing Company. One hundred-percent pipe area, venturi and round- and diamond-port types in a variety of metals for working pressures of 150-psi steam, 200-psi oil-water-gas and A.S.A. 150- and 300-psi are discussed as well as complete lines of lever-operated and worm and gear valves.

Circle 26E on reply card

Ingersoll-Rand Company has released Form 4187 that describes in detail equipment for fast and economical reconditioning of rock drilling equipment, including bits and steel. The line is complete with furnaces, sharpeners, drill-steel cutters and a series of grinders for small and large Carset and steel Jackbits.

Circle 27E on reply card

Prefabricated insulated-piping systems that can be used underground or overhead for steam, condensate or other fluids are described in a well illustrated 28-page catalogue (No. 100) issued by E. B. Kaiser Company. Designs and suggested specifications for any requirement, step-by-step on-the-job installation diagrams as well as graphs and tabulated technical data are presented. *Circle 28E on reply card*

Power-Pak packaged automatic steam or hot water boilers delivering pressures up to 15 psi and with capacities from 8 to 25 hp are described in Bulletin No. 1233 issued by Orr & Sembower, Inc. Dimensions, weights and ratings are tabulated and front- and rear-view illustrations furnished. The units are designed for use in industrial plants, warehouses, office buildings and the like.

Circle 29E on reply card

General information, product description, application and curing procedures of high strength epoxy resin adhesives for bonding impervious surfaces are discussed in an 11-page technical bulletin available from Adhesives and Coatings Division, Minnesota Mining and Manufacturing Company.

Circle 30E on reply card

Specifications and isometric drawings for Pioneer steel-shaft hangers, pillow blocks, Hallowell solid and split cast-iron collars and hanger and split-journal bearings are given in *Power Transmission Equipment*, a Standard Pressed Steel Company brochure.

Circle 31E on reply card

Among L.O.F. Glass Fibers Company's new products discussed in a recent flyer are Microlite, Super Fine and Microtex insulating blankets. Charts are included illustrating the acoustical and thermal values of these three flame-blown glass-fiber insulations. *Circle 32E on reply card*

LOW-COST
Transportation System

Moving air, water or materials wherever you need them on construction jobs is a simple matter with a dependable vehicle like Naylor Spiralweld pipe.

This distinctive steel pipe is light in weight – easy to handle and install, even over the roughest terrain. But, don't let this light weight fool you because Naylor pipe is built with the exclusive lockseamed, spiralwelded structure that gives you the extra strength and safety that you'd normally expect only in heavier-wall pipe.

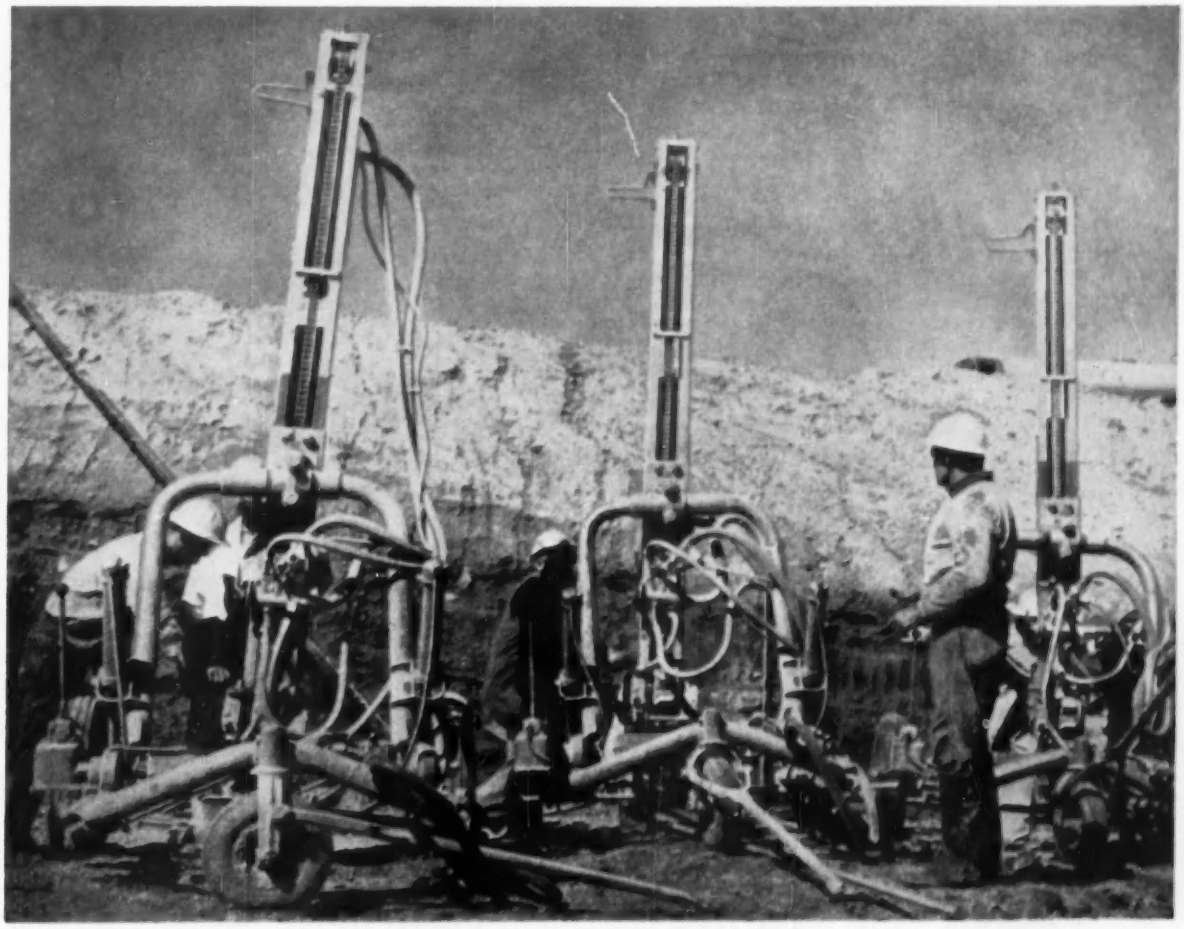
The same light weight that simplifies handling and installation also pays dividends in lower costs. And further economy in time and money is assured through use of the one-piece Naylor Wedgelock coupling—the fastest method of pipe connection available today.

Naylor pipe sizes range from 4 to 30 inches in diameter to take care of your needs in air and water lines, ventilating systems, and materials handling lines. *Write for Bulletins No. 507 and No. 513.*

NAYLOR

NAYLOR PIPE COMPANY
1245 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office:
350 Madison Ave., New York 17, New York



Making blast holes with Bethlehem Hollow during early stages of construction for Long Sault Dam. Contractors are Walsh Construction Co. and B. Perini & Sons; Morrison-Knudsen Co.; Peter Kiewit & Sons; Utah Construction Co.

240,000 cu yd of Dolomite Being Moved for Long Sault Dam on St. Lawrence

What you see here is Bethlehem Hollow Drill Steel making blast holes in dolomite at the site selected for Long Sault Dam, near Massena, N. Y. The dam, part of the St. Lawrence River Power Project, is to be a curved concrete gravity-control structure, 2890-ft long. Including earth wing dams, its eventual length will be 7340 ft. Its 30 ogee spillway openings will be controlled by 50 ft x 28 ft vertical lift gates, flanked by concrete overflow sections and earth embankment to high ground at each end.

Bethlehem Hollow was used almost exclusively on this job, in ⅞-in. hexagons and 1¼-in. rounds, fitted with carbide-insert bits. Because of the rock condition, blast holes were limited to 5 ft. The drill steel performed economically, with minimum breakage.

Wherever there's rock to be moved, whether for a dam or highway, or in a mine, or some other application, you can count on good, steady performance from Bethlehem Hollow. That is because it is rolled from a special grade of steel which is resistant to fatigue. Bethlehem Hollow has a uniform hole, centrally located in the bar. It also has a wide quenching range, and is easy to heat-treat for the proper balance of toughness and wear-resistance, making possible long-wearing threads and strong shanks.

Bethlehem Hollow is made in carbon and ultra-alloy grades, in rounds, hexagons and quarter-octagons, generally in lengths of from 18 ft to 25 ft. It also comes in longer lengths to meet special needs. Keep Bethlehem Hollow in mind for your next rock-removal project.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL CARBON AND ULTRA-ALLOY

BETHLEHEM STEEL

Good News Norgren

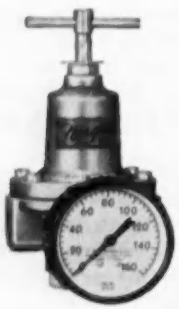
for design engineers and PLANT ENGINEERS

ANNOUNCES

Important New Developments in Compressed Air Filters and Pressure Regulators

NEW Norgren Air Line Filters

- **LESS PRESSURE DROP** — larger passages and larger filter element.
- **BETTER LIQUID REMOVAL** — Improved louver plate and baffle design. Removes more liquid from the compressed air line.
- **CHOICE OF FILTER ELEMENT**—interchangeable filter elements, 74, 64, or 25 micron.



NEW Norgren Pressure Regulators

- **GREATER ACCURACY OF REGULATED PRESSURE** — balanced valve and increased effective diaphragm area provide improved accuracy over a wide operating range.
- **RELIEVING OR NON-RELIEVING TYPE AVAILABLE**
- **IMPROVED RELIEVING CHARACTERISTICS** — automatic relief of excess pressure. Holds system pressure close to regulator setting.

For complete information...

call your nearby Norgren Representative listed in your telephone directory—or

WRITE THE FACTORY FOR NEW CATALOG.

C. A. NORGREN CO.

3407 SOUTH ELATI STREET • ENGLEWOOD, COLORADO

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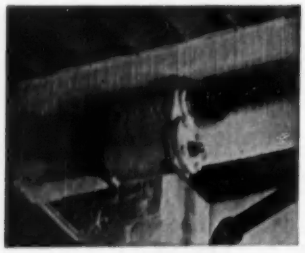
Circle 19A on reply card

DEPENDABLE PNEUMATIC SERVICE

WHEN EQUIPMENT IS PROTECTED BY DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected.

DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

NEW JERSEY METER COMPANY

PLAINFIELD, NEW JERSEY

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BEARIUM METAL superiority proved in over 25 years of "on-the-job" service in scores of varied applications.

Special castings made to customer's specifications.

Wherever there is a bearing application involving high speeds, poor lubrication, heat-generating loads, elevated temperatures, dusty and gritty surroundings—or where a liquid other than oil is used as a lubricant—there you will find the ideal application for BEARIUM METAL. For it is under adverse operating conditions such as these that BEARIUM METAL out-performs all other types of bearing materials . . . by prolonging bearing life, preventing shaft seizure and scoring. In short, it does a more efficient job longer at lower operating cost.

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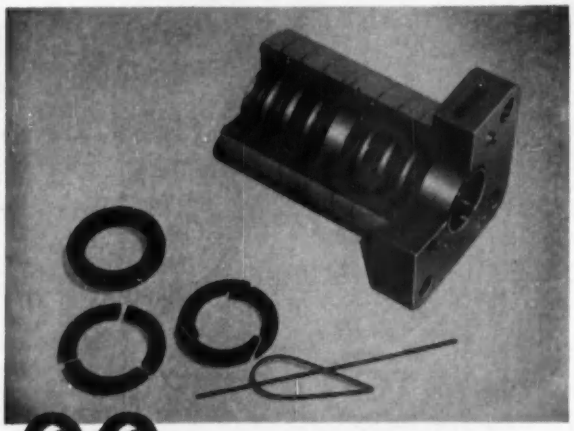

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Cook carbon packing rings are made of a special carbon graphite material that automatically assures you *high resistance to wear, chemical inertness and excellent heat conductivity.*

If you have sealing requirements for non-lubricated compressors, write today for a sample carbon ring, plus literature on Cook's complete line of packing materials. Address C. Lee Cook Company, 930 South Eighth Street, Louisville 3, Ky.

C. LEE COOK COMPANY

Sealing Pressures Since 1888

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Circle 23A on reply card

IMPOSSIBLE WITHOUT EXPLOSIVES

The modern highway—wide and spacious with increased visibility and no cross traffic—is a tribute to modern construction techniques. The above section of U.S. 99 between Bakersfield and Los Angeles, California, is a good example of engineering know-how. Where rock was encountered, blasting crews with Hercules explosives took over.

For more than forty years, Hercules has engaged in continuous research into the development of explosives materials and improved blasting techniques. Whether your requirements are for construction, mining, quarrying, seismic prospecting, or in other fields where explosives are needed, Hercules technical representatives will be glad to assist in the selection of the right materials for the most efficient job.

HERCULES POWDER COMPANY

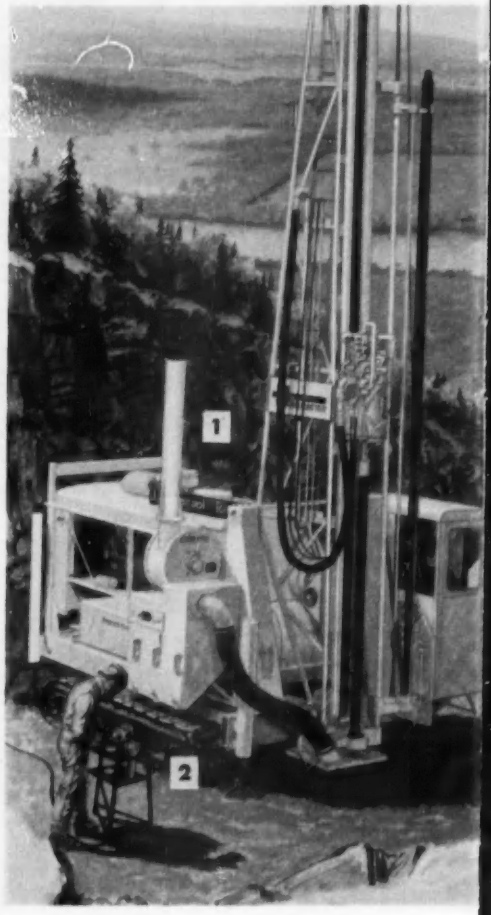
Explosives Department, 932 King Street, Wilmington 99, Del.

Birmingham, Ala.; Chicago, Ill.; Duluth, Minn.; Hazleton, Pa.; Joplin, Mo.; Los Angeles, Calif.; New York, N. Y.; Pittsburgh, Pa.; Salt Lake City, Utah; San Francisco, Calif.

XR56-2

How IR Equipment fits into the

. . . helping to meet contract dates every bit of the way



1 **DRILLMASTER** – Completely self-contained, self-propelled blast-hole rig for rotary or percussion drilling with the advanced design "down-the-hole" drill.

2 **BIT GRINDER** – Air-powered hand grinding unit and stand for fast, on-the-spot resharpening of large-size Carset Jackbits.

3 **WAGON DRILLS** – Provide complete flexibility for fast, efficient drilling in any position. Easily moved about by hand or with air hoists mounted on the unit.

4 **JACKHAMERS** – A complete line of hand-held drills with the right combination of weight and power for secondary drilling jobs.

5 **GYRO-FLO PORTABLE COMPRESSORS** – Smooth-running, dependable, virtually maintenance-free rotary air compressors in sizes from 85 to 900 cfm.

6 **CRAWL-IR** – Completely new, self-propelled, air-powered, crawler-mounted drill, with hydraulic or manual control of drill tower tilt and swing.

7 **HYDRA-BOOMS** -Gyro-Flo powered and mounted on a truck or tractor, they speed multiple hole drilling at any angle.

8 **QUARRYMASTER** – The larger completely self-contained and self-propelled blast-hole drilling rig for drilling large diameter holes with "down-the-hole" drill.

9 **FORM-PIN DRIVERS** -Standard I-R Paving Breakers with special front-heads, drive pins as fast as you can set them.

10 **DUAL-DRILL RIG** – Specially designed for simultaneous two-hole drilling in trench work.

OTHER I-R EQUIPMENT FOR ROAD BUILDING


Carset Jackbits


Bit & Rod Shop Equipment


Jackdrills and Jacklegs


Paving Breakers


Paving-Breaker Accessories


Air Diggers


Backfill Tampers


Sump Pumps


Air Drills


Impactools


Multivane Grinders


Riveters and Chipping Hammers


Concrete Vibrators


Air Saws

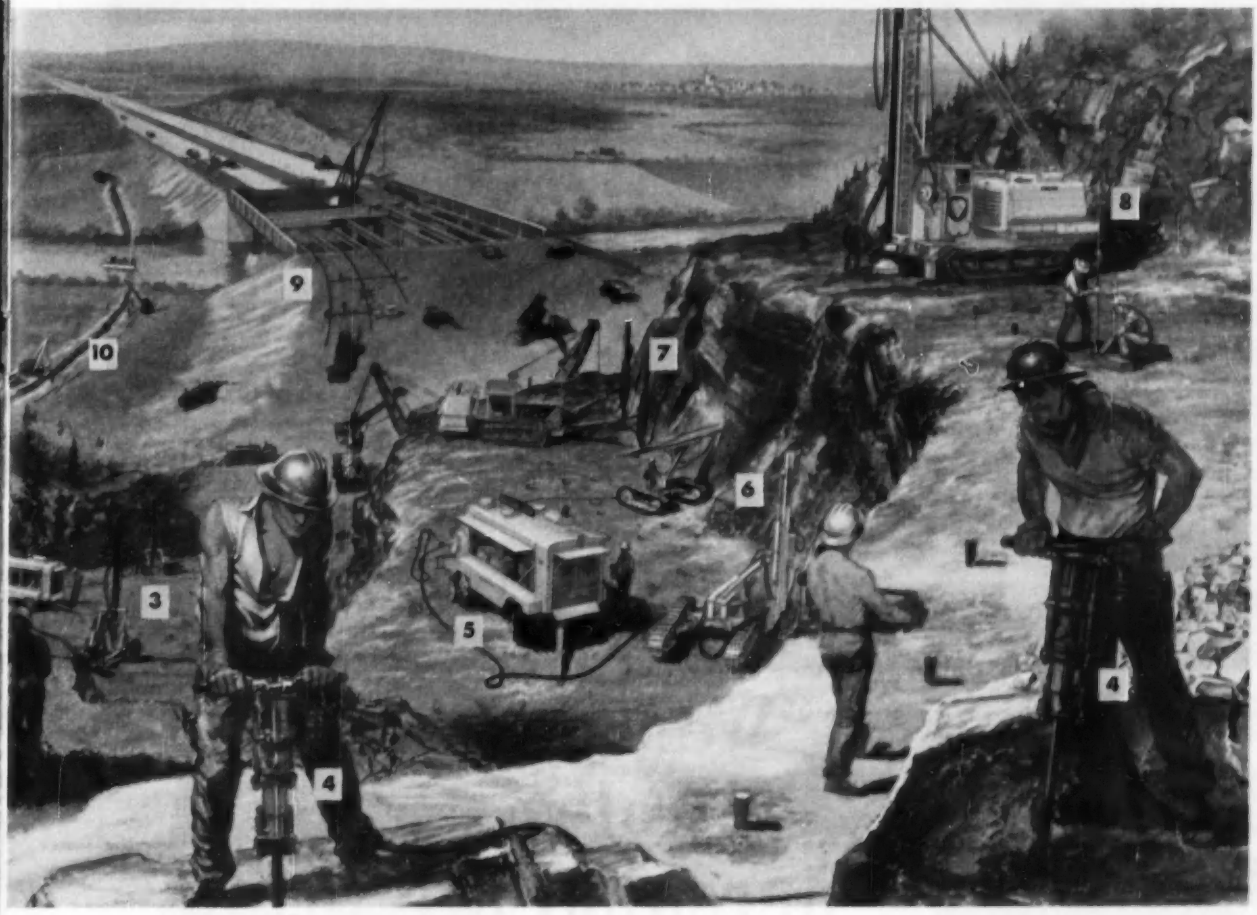

Air Hoists


Spot-Air Compressors


Stationary Compressors


Motorpumps

Highway Construction Picture



FROM big rock cuts to form-pin driving and backfill tamping, Ingersoll-Rand air power equipment plays a leading role in modern highway construction.

The first and biggest job on many sections is to *get out the rock* – and that's where the complete I-R line of rock drills and compressors can speed up the work every bit of the way.

On tunnel jobs, too, as well as in ditching and pipelining, specialized I-R drilling equipment saves time, effort and expense – helps you keep to schedule all along the line.

Work-saving air tools cut costs on bridge and structural steelwork, on wood forms and shoring, concrete vibrating and literally hundreds of jobs where operator fatigue can be reduced by use of low-cost Ingersoll-Rand air power.

Shown here are the major items of Ingersoll-Rand equipment for modern highway construction – all designed and built to work together as a time-saving, cost-saving *Contractors' Combination*. For the complete story, be sure to see the Ingersoll-Rand exhibit, Booth No. 712 at the Road Show – or write for your copy of Bulletin No. 202D.

IR CONTRACTORS' COMBINATION

14-474

BUILD BETTER ROADS TODAY · FOR A GREATER AMERICA · See you at the ROAD SHOW CHICAGO Jan. 28-Feb. 2, 1957 · AMERICAN ROAD BUILDERS ASSOCIATION

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

Circle 24A on reply card

Pictured above are Sidney A. Lewis of the Walworth Sales Staff, Lewis A. Crabb of Machlett Laboratories and Jack I. Hoffman of the Connecticut Plumbing Supply Company, discussing plans for a new and complex piping installation. The smaller view shows a few of the lines for which Walworth PVC Valves and Fittings were selected.

"We can count on Walworth for personal attention"

Says Lewis A. Crabb, chief maintenance engineer of Machlett Laboratories, Springdale, Conn.

When the Machlett Laboratories faced a specialized problem in the piping of waste acids of all types, including those used for etching, they needed more than fine valves and fittings. They required the kind of personal help and advice that comes only with sound experience.

Sidney A. Lewis, of the Technical Sales staff of Walworth sat down with Mr. Crabb, studied the problem and helped to select the exact Walworth equipment that would give the best possible service.

Backing up Walworth products with friendly capable technical help is regular procedure with all of our staff. On your next problem involving valves and fittings, call Walworth.

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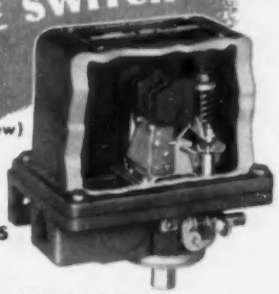
EXPLOSION-RESISTING PRESSURE SWITCH



(cutaway view)

FOR AIR COMPRESSORS AND PUMPS USED IN HAZARDOUS LOCATIONS

THESE FEATURES ADD UP TO A BETTER SWITCH:

- 200 lb. range and usual differential for air compressors and pumps
- Tamper-proof adjustment
- "Power-house" over-center spring fixed for positive action regardless of switch adjustment
- Externally mounted release valve protects against corrosion of internal parts

Also available in WATER-TIGHT construction

***Write** for Bulletin 9013-G.*
Address Square D Company,
4041 N. Richards St., Milwaukee 12, Wis.

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE

SQUARE D COMPANY

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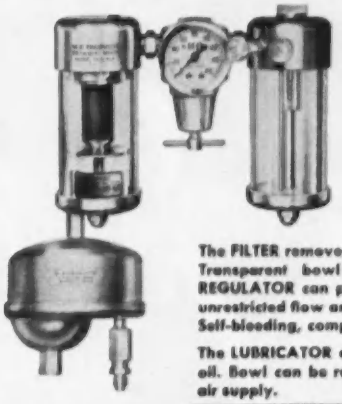
GREATER PROTECTION to your AIR LINE!

M·B

WHIRL-A-WAY FILTER, REGULATOR AND LUBRICATOR ASSEMBLY AND AUTOMATIC AIR TRAP (MODEL W-4)



SUCCESSFULLY USED FOR PROTECTION OF AIR VALVES CYLINDERS CONTROLS PNEUMATIC TOOLS, ETC.

The FILTER removes solids .00039 and larger. Transparent bowl provides visibility. The REGULATOR can pass large volume with an unrestricted flow and minimum pressure drop. Self-bleeding, compact.

The LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

The Air Trap is automatic and eliminates manual draining.

M·B PRODUCTS
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BUY BOTH BOOKS FOR $5.00

COMPRESSED AIR DATA (Fifth Edition): 346 pages on the theory and practice of compressed-air engineering. 12 chapters devoted to terminology and definitions; theoretical compression of air; boosters and vacuum pumps; turbo or centrifugal blowers and compressors; tables and data; intake air; after-cooling, intercooling, reheating; cost of compressing air; pumping with air; gas compression; installation of compressors; belting; application and performance; and measurement of air flow. Many illustration and formulae.

CAMERON HYDRAULIC DATA (Twelfth Edition): 240 pages on hydraulics, water data, miscellaneous liquids, steam data, electric data, and miscellaneous data. Hundreds of tables, curves, and formulae. The tables showing friction losses in pipe are believed to be the most complete ever offered in one book. An entirely new set of friction tables based on the Fanning formula is included for liquids of various viscosities in standard steel pipes ranging from 1" to 20". The book is almost a "must" for engineers dealing with such steam- and liquid-handling equipment as pumps, pipe systems, steam condensers, steam turbines, steam-jet ejectors, heat-transfer equipment, and water vapor refrigeration units.

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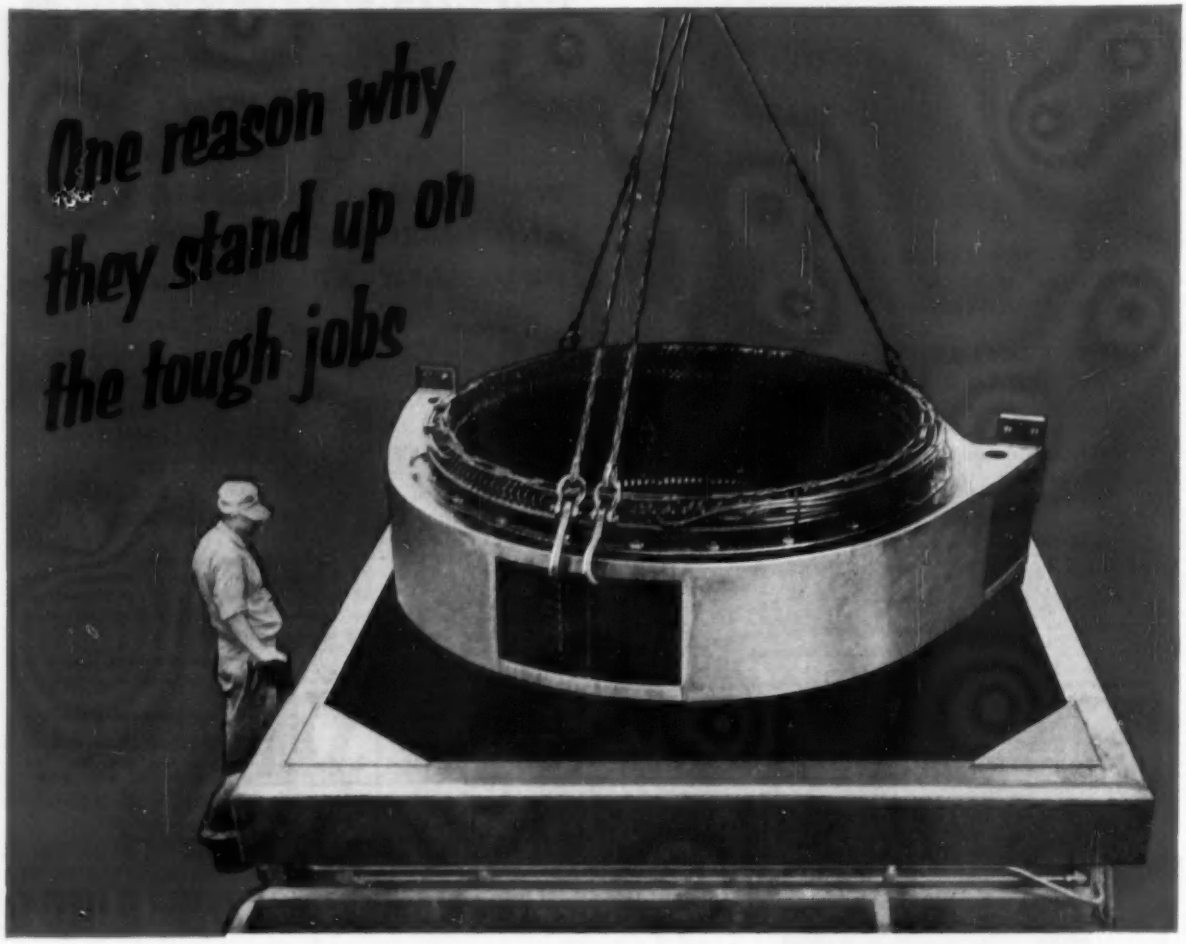
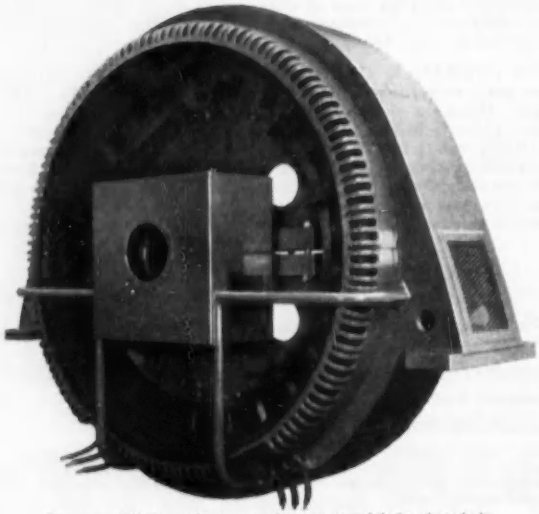


ELLIOTT SYNCHRONOUS MOTORS



The same Elliott synchronous motor now completed and ready to be shipped to a northeastern chemical plant where it will drive a compressor. Motor is rated at 3500 hp and 300 rpm and has an enclosure over collector assembly for pressure ventilation.

RG-15

A COMPLETE STATOR DIP IN THE INDUSTRY'S LARGEST INSULATING VARNISH TANK is an essential step in the special painstaking coil insulation process for synchronous motors that operate in paper mills, chemical plants, power stations and rubber mills where severe moisture, chemical fumes, abrasive or conducting dust conditions prevail. Unlike the usual spray method of varnish application, complete penetration and coverage is assured by complete immersion. After baking, the coil ends are given two additional dips and bakes to further protect against the entrance of moisture, chemical fumes, dust, etc. Better coil insulation is one of a number of "extras" that help make Elliott synchronous motors first choice for compressor, ball mill, rolling mill, pulp grinder, and many other tough service drives.

Ask your Elliott field engineer for details or write Elliott Company, Ridgway Division, Ridgway, Pa.

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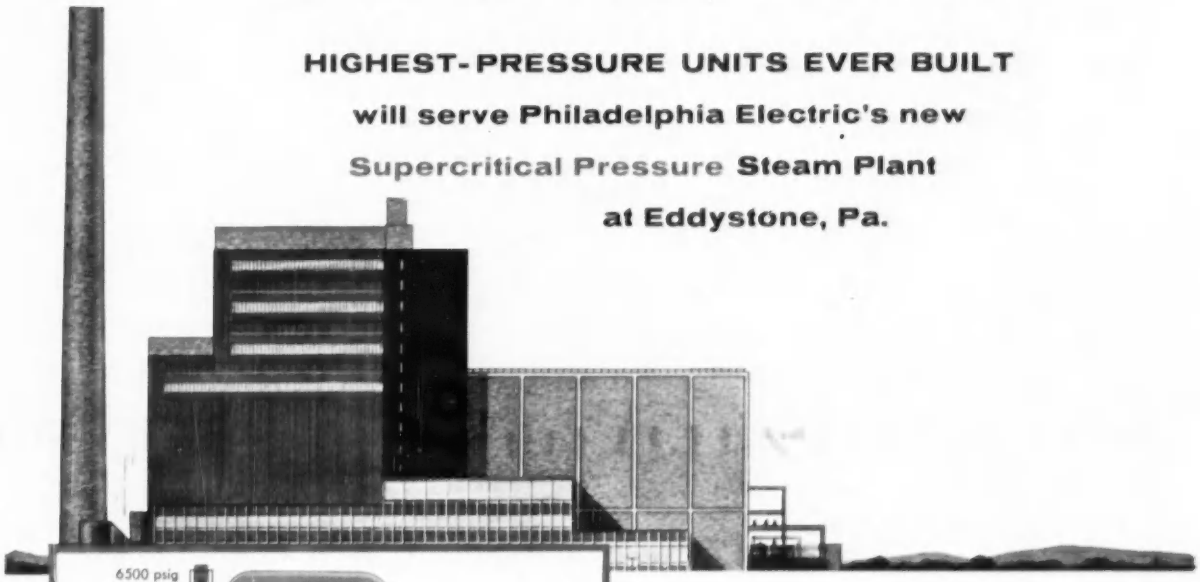
BOILER-FEED PUMPS

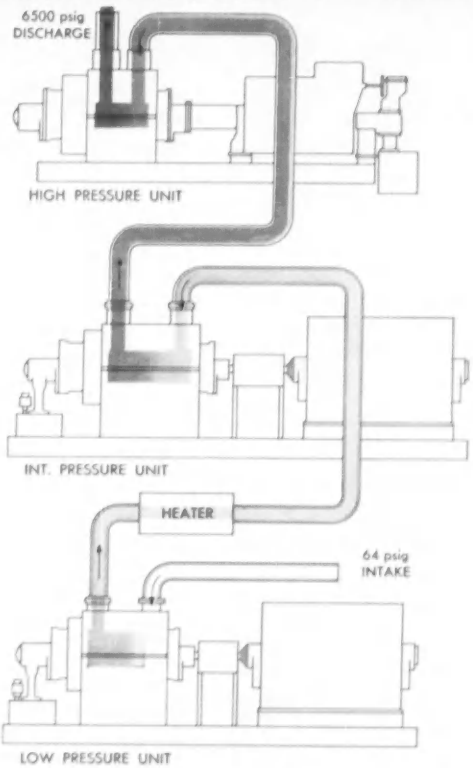
HIGHEST-PRESSURE UNITS EVER BUILT

will serve Philadelphia Electric's new

Supercritical Pressure Steam Plant

at Eddystone, Pa.





Feed water at approximately 6500 psig will be provided by six CHTA pumps, operating as two half-capacity pumping units. Each pumping unit will consist of 3 pumps in series as shown above.

SCHEDULED to go on the line in 1959, Philadelphia Electric Company's 325,000 kw Eddystone Station will operate at a higher steam temperature and pressure than any installation thus far announced. Using supercritical pressure and two reheat stages, it will require less fuel per kw-hr than the most efficient power station now in operation.

The steam generator will be served by six Ingersoll-Rand double-case pumps. To provide the required pressure and capacity they will be arranged as two half-capacity pumping units each consisting of three pumps in series. The suction pressure will be 64 psig and the discharge approximately 6500 psig. The final discharge temperature is 575°F. Featuring Ingersoll-Rand's proven *Unit-Type Rotor Assembly*, these pumps will be the highest-pressure boiler feeders ever built. Special stuffing box designs will be used to control leakage at this supercritical pressure.

The selection of I-R pumps for this historic installation reflects the confidence of Philadelphia Electric Company in Ingersoll-Rand's ability to design and build equipment for pressures and temperatures never before encountered in boiler-feed service.

Whatever your boiler-feed requirements, they can be met to advantage with Ingersoll-Rand centrifugal pumps of proved dependability and economy.

Ingersoll-Rand

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10-465

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

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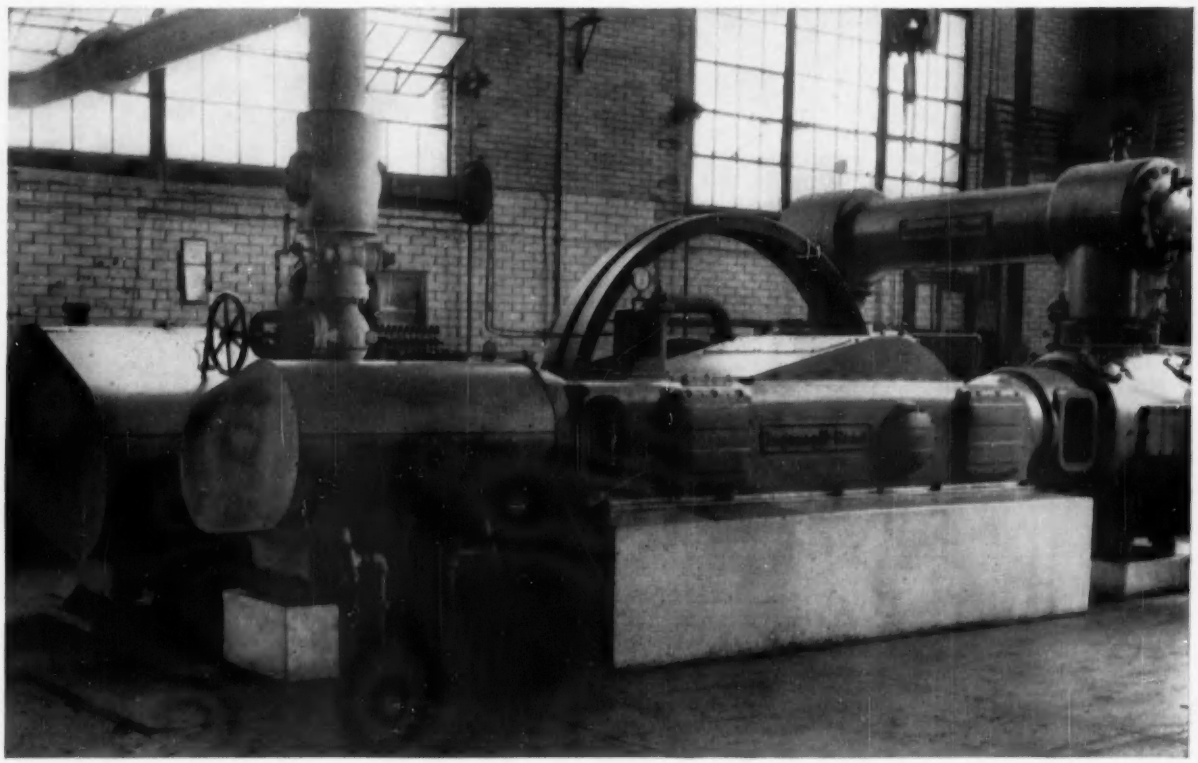
HOW TO KEEP COMPRESSOR MAINTENANCE COSTS DOWN

● *Effective lubrication—**Texaco**—is the key to low air compressor maintenance costs. **Texaco Regal Oil R&O** is the **ideal lubricant.** It keeps compressor systems clean, free from harmful deposits and rust.*



Texaco Regal Oil R&O is specially refined, then fortified with additives that increase its oxidation resistance and its ability to prevent rusting. You'll have no harmful deposits, no sludge formation. Discharge passages stay clear, valves work properly, wear is negligible. You get full compression at the lowest operating cost.

There is a complete line of *Texaco Regal Oils R&O* to meet the requirements of compressors under all operating conditions. A Texaco Lubrication Engineer will gladly help you select the correct one.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

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